MP MASTER
MA33097

WILTRON

MODEL 9361B
SIGNALING TEST SET
OPERATION AND
MAINTENANCE MANUAL

INCLUDING OPTIONS 1 THRU 14,
AND 21, 22, 23.

WILTRON

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WARRANTY

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MANUAL CHANGES

MODEL 9361B SIGNALING TEST SET
OPERATION AND MAINTENANCE MANUAL

Change #1

A. On page 3-3, Table 3-1, change the Send Loop Resistance specification to read as follows:

"...over a range of 0 to 3100 ohms, in 100-ohm steps."

B. On page 4-7, Table 4-7, make the following changes:

1. Change the latter portion of step 3 to read: "...go to the Maintenance section, paragraph 7.15."

2. Insert a new step between steps 1 and 2, to read as follows: "On the LOOP/-B&G panel, patch the SEND jack to the RCV jack, using a 310-310 cord."

C. On page 4-15, Table 4-12, make the following changes:

1. In step 1, add the following switch setting: "SEND PPS: 12."

2. Change step 5 to read: "Dial a 9. Listen for A-relay operation and observe the pps reading on the display."

3. In step 6, change the second sentence to read: "Listen for the A-relay operating continuously at 12 pps."

D. On page 5-1, Table 5-1, change the first sentence of step 1 to read: "Select the RECEIVE PPS and MON SEND switches (Figure 5-1)."

E. On page 5-3, Table 5-2, change the first sentence of step 1 to read: "Select DISPLAY % BRK and MON SEND switches (Figure 5-2)."

F. On page 8-1/8-2, paragraph 8.02(B), make the following changes:

1. Change the first sentence of this paragraph to read: "If ballast (resistance) lamps are included in the 9361B, check them as follows:"

2. Delete step 5.

23 March 1984

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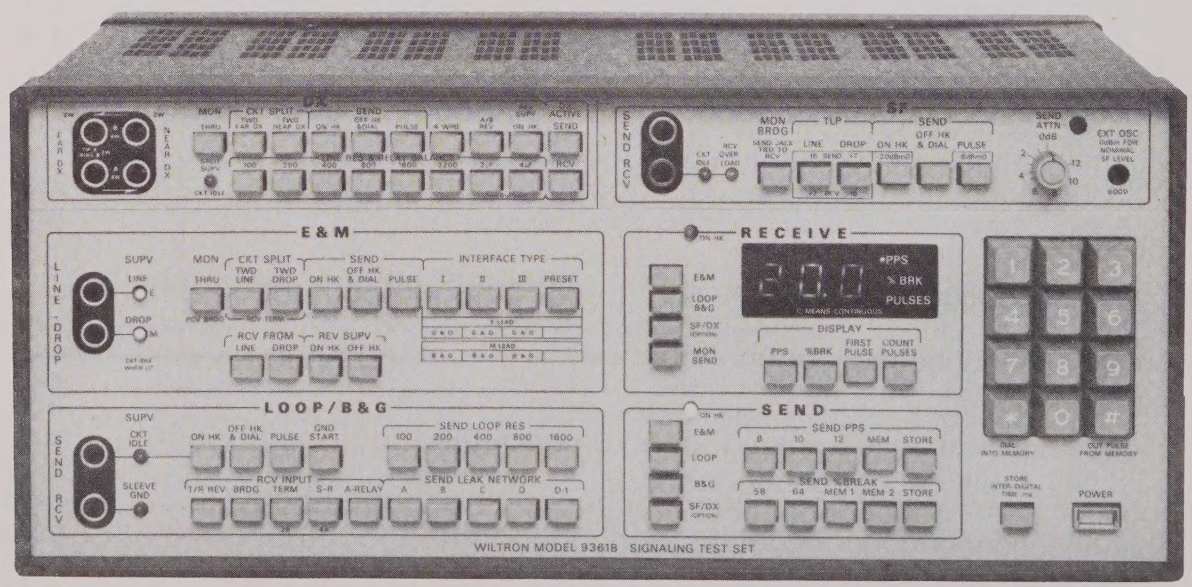

Figure 1-0. Model 9361B, Portable Version, with SF and DX Options

SECTION I

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1. GENERAL

1.01 INTRODUCTION

This instruction manual contains operating instructions for the WILTRON Model 9361B Signaling Test Set. The manual is organized as follows:

SECTION I, GENERAL INFORMATION, contains a description and specifications.

SECTION II, INSTALLATION, provides installation information.

SECTION III, FUNCTION OF CONTROLS, INDICATORS, AND CONNECTORS, gives a detailed description of the controls and indicators for both the standard Test Set and the options.

SECTION IV, PERFORMANCE VERIFICATION, enables the operator to check the basic functions of the Test Set to determine whether it is operating properly.

SECTION V, TEST SET OPERATING PROCEDURES, contains the operating procedures.

SECTION VI, ON-LINE OPERATING PROCEDURES, describes in full, with schematics and illustrations of connecting configurations, how to connect the test set to circuit and make the measurements for pulses per second, % break, first pulse distortion, and counting pulses on a single train. Connection and operating information is provided for E&M, Loop, B&G, SF, and DX circuits.

SECTION VII, MAINTENANCE, is a procedure for adjusting the pulsing and A-Relays. These adjustments need not be attempted unless the performance verification checks indicate that adjustment of these components is required.

SECTION VIII, TROUBLESHOOTING PROCEDURES, gives the troubleshooting procedures that can be performed by the operator. In the event of more complex troubles, call the Customer Service Department at WILTRON.

1.02 DESCRIPTION

The Model 9361B Signaling Test Set is used in telephone central offices to test or monitor the incoming and outgoing dialing and supervision of signaling equipment.

The test set employs a modern microprocessor design with independent send and receive capability. The sender provides both preset and user-programmed values (in memory) for pulses per second (PPS) and percent break (% BRK). The 9361B also provides selectable interdigital timing and no-wait digit dialing with automatic repeat dialing of last number dialed.

The receiver has pushbutton controls for selecting the following measurement functions: PPS; % BRK; First Pulse Distortion; and Count Pulses. Measurements are made on a single pulse train or on a string of continuous pulses.

Measurements can be made on all types of dial pulse signaling circuits, including E&M, Dry Loop, Battery and Ground (Wet Loop), and SF circuits. The E&M interfaces include the traditional E&M as well as the newer interfaces for electronic switching offices and TSPS applications.

Other applications of the test set include signaling measurements on incoming and outgoing trunks, both 2-Wire and 4-Wire, subscriber loops, and telephone sets.

Up to eight remote displays (optional) can be used with the Signaling Test Set. The remote displays are readable from up to 30 feet away.

Connections to the test set are made through front panel jacks or from remote jack multiples connected to the rear panel.

The Signaling Test Set is also used with the WILTRON DTMS and ITMS Transmission Measuring Systems. Existing WILTRON Display Housings can be used to house remote signaling displays up to 1000 feet from the Signaling Test Set.

(A) Send Features

- Selection of one variable and three fixed preset pulse-per-second (PPS) rates.

- Selection of two variable plus two fixed preset percent break (% BRK) settings.

- Digits dialed using the front panel keypad are sent at the selected PPS rate and % BRK. There is no waiting time to enter additional digits while previous digits are being sent. The desired interdigital time is automatically inserted between digits.

- Up to 25 digits from the keypad can be stored, and can be sent when and as often as desired using a single front panel pushbutton. The sending rate in PPS and the % BRK period can be varied for each transmission, as required.

- Interdigital time is selected from the front panel.

- Extremely accurate crystal-controlled timing circuitry controls the PPS,% BRK, and interdigital timing. No zero or calibration controls are required.

- An ON HK indicator lamp shows that all front panel switches are properly set to send pulses. The indicator flashes each time a pulse is sent.

- The SEND output can be connected for E&M, Loop, B&G, or SF (optional) signaling modes.

- The sender pulses can be monitored.

- E&M - Capable of sending three commonly-used E&M connections, plus a customer-selected interface type. Send or measure capability toward the Line or Drop with On-Hook or Off-Hook reverse supervision is provided through front panel jacks or rear panel inputs. Capability is also provided to send On- or Off-Hook, continuous pulsing, or dial to either Line or Drop connections.

- Loop/B&G - Capable of sending dry loop or Battery and Ground (wet loop) from front panel jacks or customer jacks. Balanced loop resistance from zero up to 3100 ohms in 100-ohm increments can be added to the sender output. Leak networks A, B, C, D, and D-1 are pushbutton-selectable. Also pushbutton-selectable is On- or Off-Hook, continuous pulsing, or dial to the line under test. A far-end reverse supervision indicator is provided to show when the far end of the line is idle. A "ground start" pushbutton provides a ring ground to a desired

circuit. Telephone resistance lamps (T&R) are included to provide a conventional resistive battery.

- SF/DX - Connects the sender to the optional SF or DX adapter panel.

(B) Receive Features

- All measurements are simultaneously made on a single received pulse train and may be selected for display as desired (PPS, % Break, First Pulse, or Count Pulses).

- The measured results are displayed for up to 10 seconds from the time the last display mode was selected, if no additional pulses are received. An ON HK lamp is provided to indicate when pulses are being received for measurement. The lamp flashes with each pulse. Two pulses or more are required for a measurement (since two pulses are needed to define one complete input cycle).

- The microprocessor-controlled receiver is able to measure the PPS of a pulse train over a range of 5.0 to 29.9 PPS. The PPS measured is the average over the number of pulses received, or the average of the last 12 pulses when continuous pulses are being measured.

- The % Break range is 10 to 90% break (see Figure 1-1).

- The First Pulse pushbutton provides display of the % BRK of the first pulse received. This is useful in analyzing the individual pulse distortion of received pulses.

- The Count Pulses pushbutton provides a display of the number of pulses received. This is useful for verifying or testing dial mechanisms and checking for split or dropped pulses.

- The Receive Display provides LED indicators to show which measurement function (PPS, % BRK, PULSES) is being displayed.

- The Receiver can be connected to either E&M, Loop, B&G, SF/DX (optional), or MON SEND.

- E&M - Capable of selecting E&M functions toward either the line or the drop. The interface type pushbuttons allow connections, plus a customer-selected E&M interface. The accessed circuit can be monitored with a high-impedance through-path mode (to determine if the circuit is idle or to monitor traffic). Measurements can be made toward the Line or the Drop, with the receiver automatically terminated.

- LOOP/B&G - Measurements can be made through an A-Relay, through an electronic relay (S-R)*, resistively terminated, or in a high-impedance bridging mode. The A-Relay is mounted internally and is accessed by the front panel pushbutton, without additional patch cords. It is used when A-Relay response characteristics are needed to be included in the results. Resistively-terminated measurements are made when it is necessary to measure the pulses driving the Office relay (A-Relay bypassed mode). Electronic relay (S-R) measurements are used to measure pulsing relay contacts in the presence of contact protection or a leak network. The bridging mode permits measurements on an active circuit using the signaling traffic present. This eliminates the need for a craftsman in the far-end office to send pulses. Reverse supervision is provided with the T/R REV switch. A "sleeve ground" indicator shows when the sleeve has been grounded by the office equipment to represent on- and off-hook conditions.

- MON SEND - Measures the output of the built-in sender and displays PPS, % Break, First Pulse distortion, or Count Pulses, as selected.

- SF/DX (Optional) - Connects the receiver to the optional SF and/or DX panels.

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* The S-R Control is provided in units with serial number 905001 and up.

1.03 DESCRIPTION OF OPTIONS

A selection of options is available to expand the testing capabilities of the basic Model 9361B Signaling Test Set (see Table 1-3). The Talk/Listen, Send Remote Control, SF, and Artificial Trunk options are half-rack-width control panels normally mounted above the Signaling Test Set. The Preset E&M Interface Switches, Ac Power Converter, Preset % Break values, and Automatic Polarity Reversal are modifications of the basic test set and are normally factory-installed at the time of the order. A large remote display is also available for aisle-mounting in carrier bays to repeat measurements from the test position.

(A) Talk/Listen Panel (Option 3)

Provides audible verification that the correct number has been reached on the Loop/B&G or SF circuit. It allows the operator to talk or listen on a circuit being tested when Loop is selected, or to listen only when the optional SF adapter is equipped. This eliminates the need for a separate order wire. Transmission loss and noise measurements can be made by connecting a TMS to the Talk/Listen jacks after dialing up a test tone or quiet termination number. Option 3 is not compatible with Option 13.

(B) Talk/Listen and Send Remote Control Panel (Option 4)

This panel combines the Talk/Listen (described in (A) above) and Send Remote functions. This option is used in step offices in applications where pulsing tests must be made while standing on a ladder. Send Remote Control is provided with a hand-held remote unit on a 24-ft. cable to allow the operator to seize, release, or pulse a circuit connected to the signaling test set. LOOP and LEAK tests can be made from the hand controller. Send Remote is available only with the Talk/Listen option included.

(C) SF Adapter (Option 5)

The SF Adapter generates and receives single-frequency (SF) tones for line or drop, attenuated by a front panel selectable level control. This unit has a built-in 2600 Hz oscillator for sending the tone frequency, with an external input provided for other frequencies. Automatic level coordination is provided to simplify operation at +7 dB and -16 dB Test Level Points.

(D) Artificial Trunk (Option 6)

The Artificial Trunk option provides pulsing tests from the local end on such trunks as FX and EAS. With the far end of the trunk opened, the Artificial Trunk unit simulates the loop resistance and connects the trunk to the A-Relay in the 9361B test set. The trunk can then be pulsed as a leak network into the 9361B's A-Relay, with loop resistance simulated by the option panel.

(E) Preset E&M Interface Switches (Option 7)

The Preset E&M Interface Switches are mounted on the rear panel of the 9361B and replace the standard internal preset E&M switches. This option adds one position, allowing an M lead to go between ground and open for on- and off-hook status. It also makes it unnecessary to remove the cover of the set when a different preset E&M condition needs to be selected.

(F) Remote Signaling Display (Option 8)

The Remote Signaling Display is for carrier bay applications, and provides PPS, % Break and Count Pulse displays up to 500 feet from the 9361B test set. Up to 8 remote aisle-mounted displays can be operated from the Remote Display output. Transmission dBm and dBrnC level and noise displays from WILTRON ITMS and DTMS systems can be included in the same housing as the remote signaling display.

(G) AC Power Converters (Options 9 and 9A)

This option allows operation from an ac power line or from -48V dc. Either 115V or 230V ac ±10% can be selected. If -48V dc is applied to the test set, this supply overrides the -48V from the AC Converter.

Option 9 provides sufficient converted ac power to operate up to 2 half-rack options (Options 3, 4, 5, 6, 13 or 14). Option 9A is supplied when more than 2 half-rack options are ordered.

(H) Automatic Polarity Reversal (Option 12)

This option allows the -48V dc power input to the unit to be plugged-in with either polarity. It will automatically present power to the signaling unit with the correct polarity for operation. The power input jack is wired tip and sleeve.

(I) MF/DTMF Communications Panel (Option 13)

Option 13 provides the 9361B with tone signaling (MF or DTMF) sending capability. It also provides a 2/4-wire talk circuit by way of a headset plugged directly into jacks on its panel. A second set of jacks allows a TMS (such as the WILTRON 9041) to be connected to the Model 9361B for transmission measurements.

(J) DX Signaling Adapter (Option 14)

Option 14 provides the Model 9361B with the capability to test DX signaling circuits. With this option, either 4-wire or 2-wire DX circuits may be measured on a bridging basis to monitor traffic signaling, or the circuits may be split for testing toward either the near or the far end. The option provides resistive and capacitive loading to match the impedance of the circuit under test or optimize polar relay balance. An artificial line is included in the test circuit when splitting toward the near end to represent the resistance of the loop. The option includes an A/B lead reversal switch that aids in detecting a reversal condition of these leads. Reverse supervision on/off hook control for 2- and 4-wire DX circuits is also provided.

(K) Preset % Break Values (Options 21, 22, and 23)

The Model 9361B is available with any one of four different sets of preset % Break values.

1. 58, 64, 49 and 73 percent (for Bell System practices).
2. 60.5, 68.5, 55 and 70 percent (Option 21 -- for General Telephone and other independent telco practices).
3. 58, 66, 40 and 70 (Option 22--for Trans-Canada Telephone System practices).
4. 60.5, 68.5, 58 and 64 percent (Option 23 -- for General Telephone of California practices).

The first two preset values are marked on the front panel and the other two are represented by MEM 1 and MEM 2 designations. The latter two are also variable from 0.1 to 99.9% BRK.

1.04 EQUIPMENT MOUNTING

The Model 9361B Signaling Test Set is available as either a rack-mounted or a portable unit.

The basic rack-mounted test set occupies three rack spaces (5-1/4 inches), and the half-rack-width options occupy one rack space (1-3/4 inches) in height. Reversible end brackets are provided for flush or 5-inch extended mounting in either 19-inch or 23-inch racks. A blank panel is required when only one-half panel mounting option is ordered.

Portable units are available in one standard width (18 inches) and three heights. One height accommodates the basic test set (5-1/4 inches). The others (7 and 8-3/4 inches high) permit the selection of one or two additional rows of options -- each row having either two complete control panels or one control panel and one blank panel.

1.05 SPECIFICATIONS, ACCESSORIES, AND OPTIONS

Table 1-1 gives full technical specifications for the 9361B. Table 1-2 lists the accessories available and Table 1-3 contains the options. Tables 1-4 and 1-5 list the required features by type of telephone office and the % break ratios by telephone company.

TABLE 1-1. Specifications

GENERAL:

Send/Receive Functions: Independent for simultaneous Send and Receive operation for E & M, Loop, B & G, and SF signaling modes. Employs microprocessor-controlled Sender and Receiver, with no zero-adjust or calibration required.

Measurement Types: Pulses Per Second, % Break, First Pulse % Break, Count Number of Pulses. Measurements can be made on pulse groups as well as continuous pulse trains.

Displays: Front panel, 3 digit LED (½-inch high), plus up to 8 remote displays (when option 8 is ordered.)

Supervision Indicators: LED indicators for E & M Line and Drop, plus Loop/B & G circuit Idle and Sleeve Ground, plus SF circuit Idle and overload.

Send Monitor: Built-in monitor for measuring and displaying the Sender output.

Activity Monitors: Send and Receive indicators show On-Hook condition.

Self-Check: Automatically performs system self-check each time power is turned on.

SEND:

Dialing: Keypad and memory provide no-wait dialing, plus storage and automatic repeat dialing of a number.

Preset Speeds: 8, 10, 12, and 20 PPS.

Variable Speed: 0.1 to 29.9 PPS, adjustable in 0.1 PPS increments. The initial value is set to 20 PPS.

PPS Accuracy: ±0.2 pulse.

Preset % BK: 58, 64, 49, 73 percent break.*

Variable % BK: Two pushbuttons covering 0.1 to 99.9% in 0.1% increments. The initial values are 49 and 73%.*

% BK Accuracy: ±0.2% (E & M and dry loop); ±0.5% (wet loop).

Interdigital Pause: 1 to 999 milliseconds in 1 msec. increments, keypad selectable. Accuracy is ±2 msec.

Send Modes: Continuous pulsing, dial digits, repeat dialed number, continuous on-hook, continuous off-hook.

RECEIVE:

PPS Range: 5.0 to 29.9 pulses per second.

PPS Accuracy: ±0.2 PPS.

% BK Range: 10.0 to 90.0 (at speeds up to 20 PPS, see Figure 1). Reading averaged over pulse group, or averaged over 12 pulses if receiving continuous pulses.

% BK Accuracy: ±0.2% (E & M, or Loop/B & G using Term., or S-R) See Figure 1. On Loop/B & G bridging (BRDG): 25 to 75% BK up to 10 PPS, decreasing to 50% BK at 20 PPS.

Input Impedance:
E & M Mode: 22k bridging, 5.6k terminated line, or 3.3k terminated Drop networks.
Loop Mode: Balanced 20k bridging, balanced 400Ω TERM., or S-R, and internal "A" relay.

S-R Detector: Contact protection and circuit capacitance up to 5μF on loop and 10μF on B & G circuits do not affect % BK readings.

Receive Interdigital Time: >300 millisec.

*Two of the Preset % Break values can be varied over the range 0.1 to 99.9 % Break.

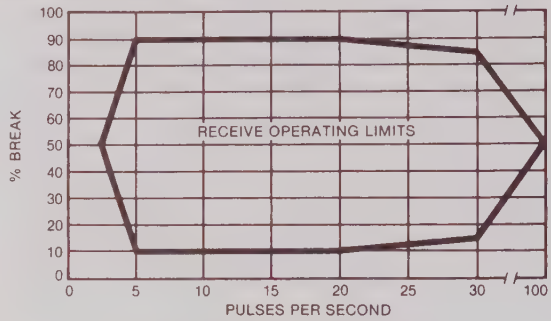


FIGURE 1. %Break as function of PPS for Loop/B&G, E&M, and SF measurements.

E&M:

Interface Types: I, II, III, and Preset, suitable for electromechanical and electronic offices as well as tandem trunk testing. (See E&M rear panel switches, page 9).

Traffic Monitoring: Provides signaling measurements and call progress status using high impedance (bridging) circuits, also indicates customer-dialed number.

Reverse Supervision: On or Off hook.

LOOP/B & G:

Send Loop Resistance: 0 to 3100Ω, in 100Ω increments.

Send Leak Networks: Types A, B, C, D, and D-1.

"A" Relay Accuracy: ±2% Break at 60.5% BK. "A" Relay calibrated with input voltage of −48.0 VDC at 12.0 PPS, 60.5% BK, 1400Ω loop, and Leak Network A selected.

Ground Start Function: Applies ground to Ring of Send jack for PBX tests.

OPTIONS:

TALK/LISTEN (OPTION 3):

Provides audible verification of call completion on Loop/B & G and SF circuits, and provides transmission measurements capability.

SEND REMOTE CONTROL (OPTION 4):

For SXS office ladder tests the hand-held remote control unit provides control of On Hook, Off Hook, and Dial and Pulse for Loop/B & G, E & M, and SF circuits. PPS and % Break, Loop and Leak values are preset to suit the switch being tested. Dialed number can be repeated from the hand unit. This option includes Option 3.

SF (OPTION 5):

Internal Oscillator: 2600 Hz

Send Level: −20 dBmO On hook, −8 dBmO Pulse

External Oscillator: 0 dBm input from 2400-3825 Hz for Send level output as shown above.

Test Level Point (TLP): Line: −16 dBm Send, + 7 dBm Receive. Drop: + 7 dBm Send, −16 dBm Receive.

dB From Send TLP Control: Reduces Line or Drop levels from 0 to 12 dB.

Supervision Indicators: Circuit idle and receive overload.

ARTIFICIAL TRUNK MEASUREMENTS (OPTION 6):

Provides trunk performance measurements from the local end of FX and EAS circuits.

Current Meter Range: 0 to 150 mA

Artificial Resistance Control: Up to 2000Ω

MF/DTMF COMMUNICATIONS PANEL (OPTION 13):

Provides capability to send MF or DTMF signaling tones, to make transmission measurements through the 9361B, and to talk on and listen to the circuit under test.

Output Tones:

MF Signaling: digits 0 through 9; automatically inserts KP and ST
DTMF Signaling: digits 0 through 9

Output Level:

Signaling Tones: −6 dBmO (per tone)
TLP at LOOP SEND Jack (900Ω): 0 dBm
TLP at SF SEND Jack (600Ω): +7 to −5 dBm at DROP, −16 to −28 dBm at LINE
TLP at SF RCV Jack (600Ω): +7 dBm at LINE, −16 dBm at DROP

Total Distortion (Signaling Tones): Below −40 dBm

DTMF Tone Duration:

Tone On: 60 msec
Tone Off: 60 msec

DTMF Tone Frequency Accuracy: ±1.1%

MF Tone Duration:

KP Code: 100 msec
Other Digits: 70 msec
Tone Off: 70 msec

The 9361B automatically inserts a KP code before the digit sequence and automatically adds an ST code at the end of the digit sequence.

MF Tone Accuracy: ±1.1%

DX SIGNALING PANEL (OPTION 14):

Provides bridging, split to line (far end) or drop (near end) signaling measurements on 2- and 4-wire DX circuits. Sending and receiving tests may be made DX/DX, DX/SF, DX/E&M, Loop/DX, and so forth.

Balance:

Resistance: 0 to 6300Ω in 100Ω steps with ±2% accuracy, in series with a fixed 1240Ω
Capacitance: 1.3, 2, 4, and 6 μF with ±10% accuracy

Artificial Line Resistance: 0 to 6300Ω in 100Ω steps automatically inserted when split to "Near DX" with ±2% accuracy.

Measurements Range and Accuracy:

Impedance: Bridging: 400 kΩ balanced.
Split to "Far DX" or "Near DX": Same as a standard DX set
Send: Same as other 9361B functions for pulsing speed, % Break, and interdigital time
Receive Bridging % Break Accuracy: ±1% Break with 3 kΩ loop resistance, increasing as shown in Figure 2. (NOTE: 2- and 4-wire DX bridging measurements may be made at any location on the DX loop — 5 to 20 PPS, 20 to 80% Break.)
Receive Split % Break Accuracy: When pulses are sent from the far end of a DX line toward a properly balanced Option 14, the effect of loop resistance on received pulses that are sent at 9.9 or 10.1 pps with % Break intervals between 20% and 80% is shown in Figure 3.
% Break Correction Factor For Pulsing Speed: The correction factor for % Break measurements in Receive Split Mode when the received pulsing speed is other than 10 pps is shown in Figure 4.

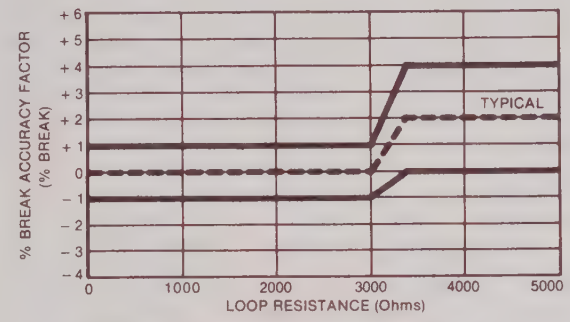


FIGURE 2. % Break accuracy of bridged measurement as a function of loop resistance.

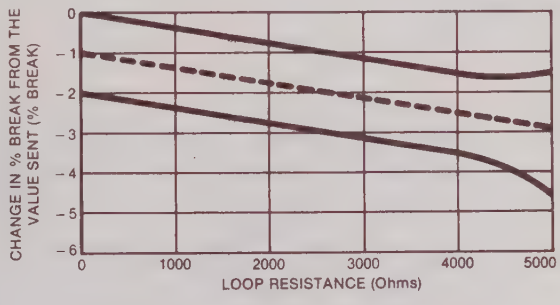


FIGURE 3. Change in % Break reading on split circuit as a function of loop resistance. Dashed curve shows typical characteristic of DX bipolar relay.

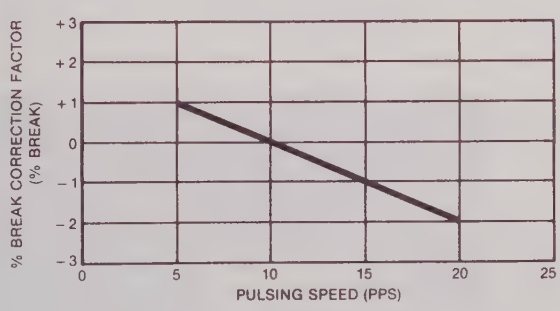


FIGURE 4. Correction Factor for Figure 3 when pulsing speed is other than 10 PPS. Curve shows typical characteristic of DX bipolar relay.

NOTE: To ensure correlation with existing DX sets, WILTRON uses a bipolar DX relay for split circuit measurements.

TABLE 1-1. Specifications (Continued)

ELECTRICAL

Input Voltage: 48 Vdc at 1.0 A max. fused at 2.0 A (115/230 Vac Power converter optional, fused at 2.0A)

Input Voltage Range:
Operating: 44 to 54 Vdc.
No damage: 42 to 56 Vdc.
Optional AC: 115/230 V ±10% 50/60 Hz

PHYSICAL

Dimensions:
Rack mount model: Reversible ears for 19″ or 23″ racks, flush mount or set forward 5″. Depth — 10.5″. Height — 5.25″. 7″ for up to 2 option panels, 8.75″ for more than 2 option panels.

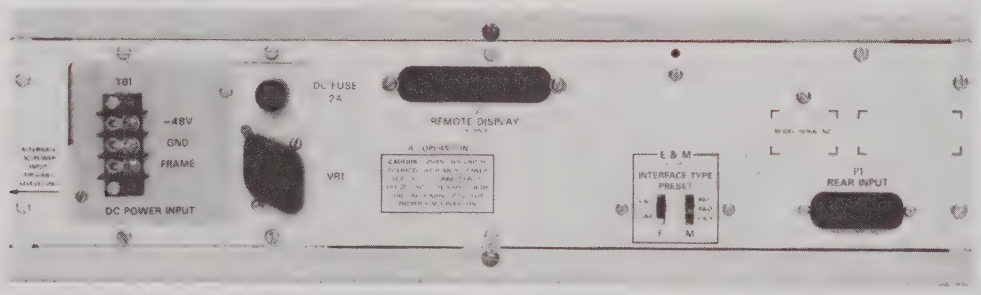
Portable model: 18″ wide X 11.25″ deep X 6.25″ high. 7.9″ high for up to 2 option panels; 9.65″ high for more than 2 option panels.

Weight:
Portable Model 9361B: 15 lbs.
Rack Model 9361B: 11 lbs.
AC Power Converter (Option 9): 4 lbs.

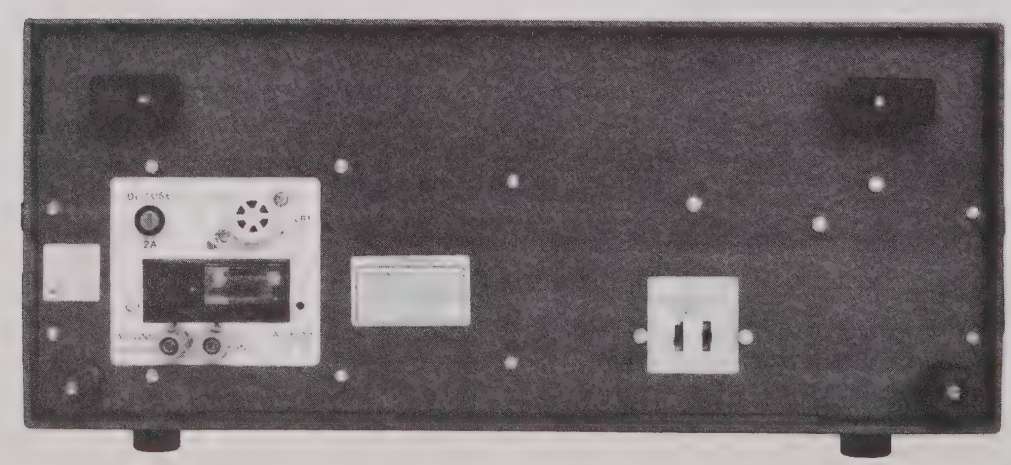
Temperature Range (Operating): 0 to 50°C

TABLE 1-2. Accessories

Description	WILTRON Part No.
Fiberglass Transit Case for portable unit	760-46
Rear panel test input connector with 10-ft. cable	9454-1
Remote Display Unit	9495-3
Extension cable for remote display (XXX = desired cable length in feet)	9450-XXXDE
AC power cord, 6.5 feet (furnished)	800-100



Model 9361B rack mount (rear view)



Model 9361B portable unit (rear view)

TABLE 1-3. List of Options

If you need:	Order Option:	This option includes:
Rack Mounting, – 48 Vdc power, ability to test E & M, Loop/B & G	None (Order 9361B only)	Rack mounting ears for 19″ and 23″ rack. – 48 Vdc operation, preset % BRK values of 49, 58, 64, and 73%. (See Note)
Portable Operation of 9361B basic unit – 48 Vdc power, ability to test E & M, Loop/B & G	1	Portable 5-¼″ high cabinet, – 48 Vdc operation (See Note)
Portable Operation with up to two ½-rack options, – 48 Vdc power	2	Portable 7″ high cabinet, – 48 Vdc operation (See Note)
Portable Operation with more than two ½ rack options, – 48 Vdc power	2–5	Portable 8-¾″ high cabinet, – 48 Vdc operation (See Note)
Talk/Listen for Loop/B & G and/or SF	3	½-rack module. (Not compatible with Option 13) (See Note)
Remote Control of On/Off Hook & Dial and of dialing stored numbers	4	Remote control unit with 25′ cable and controller, ½-rack module which includes Option 3 Talk/Listen (See Note)
SF Signaling measurements, bridging or split	5	SF Adapter ½-rack module (See Note)
Trunk Simulation	6	Artificial trunk ½-rack module (See Note)
Preset E & M Interface	7	E & M Type IV and V switches mounted on instrument rear panel
Remote Display Connector	8	Internal driver circuit and rear panel connector for connection to 9495-3 Remote Display Unit.
115/230 Vac Operation with basic unit and up to two ½-rack options	9	Internal AC to DC converter, AC power cord, side panel jack for – 48 Vdc operation.
115/230 Vac Operation with more than two ½-rack options.	9A	Internal AC to DC converter, AC power cord, side panel jack for – 48 Vdc operation
Rack Mounting for basic unit and up to two ½-rack options	10	7″ high rack ears.
Rack Mounting for basic unit and more than two ½-rack modules	10–5	8-¾″ high rack ears.
Blank Panel to cover unused ½-rack panel opening	11	Blank ½-rack panel.
Automatic Battery Polarity Reversal correction (Tip-Sleeve)	12	Internal circuit which automatically corrects applied polarity on – 48 Vdc jack.
Send MF or DTMF signaling tones, **Transmission Measurements** without disconnecting 9361B, and **Talk And Listen** on the circuit under test.	13	½-rack panel with provision to select dial pulse, DTMF, or MF signalng modes; to set up a talk path on Loop, SF, or DX circuits (SF/DX only if Option 14 and Option 5 are ordered). Provision to connect a TMS through the instrument to the circuit under test. (See Note)
DX Signaling Measurements, bridging or split	14	2- and 4-wire ½-rack DX module (See Note)
Preset % Break values of 60.5, 68.5, 55 and 70%	21	Preset % Break values required by Independent telco practices.
Preset % Break values of 58, 66, 40, and 70%	22	Preset % Break values required by Trans-Canada practices.
Preset % Break values of 60.5, 68.5, 58 and 64%	23	Preset % Break values required by General Telephone of California practices.

NOTE: 310 jacks are standard; Bantam jacks available on request.

1.06 SIGNALING PRACTICES

Telephone company operating practices for signaling tests can be used directly with the 9361B.

Practices can be greatly simplified, if desired, since there is now no need for the continually-recurring recalibration steps presently required by signaling test sets.

The number of test setups and different patch cord arrangements used in operating practices can also be reduced because of the simple, flexible, pushbutton control arrangement of the 9361B.

Application Engineering advice on methods of simplifying Signaling Practices is available upon request from WILTRON Company.

1.07 COMPATIBILITY WITH OTHER SIGNALING TEST SETS

The 9361B is easier and more convenient to use and provides more testing capability than existing signaling sets. However, the basic PPS and % Break signaling measurements made will correlate with the following signaling sets.

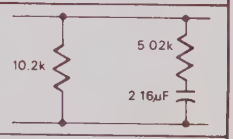
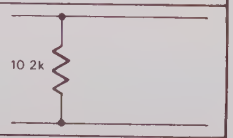
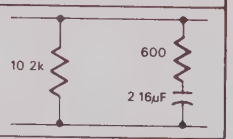
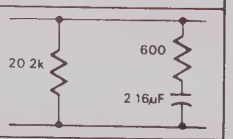
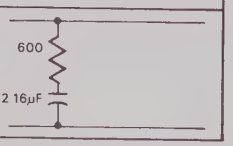
Table 1-4. Compatibility With Other Signaling Test Sets

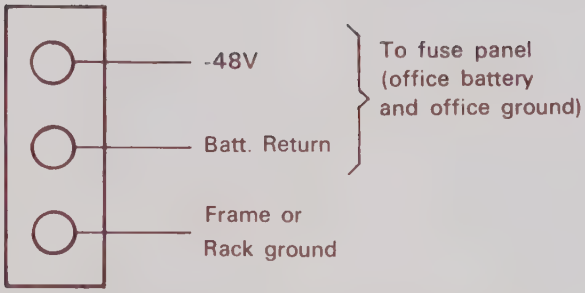
Bell System Signaling Sets	Other widely used Signaling Sets
W.E. 2B with Pulse Repeating Adapter	Lenkurt 26600
W.E. 4A with Loop, E & M and SF options	Northeast Electronics 26B with 26BXC and 26BXS options

1.08 LEAK NETWORKS

These Leak Networks are connected across the SEND jack of the LOOP/B&G circuit. They are selected by the SEND LEAK NETWORK pushbuttons in the LOOP/B&G section of the Model 9361B. The Leak Networks are illustrated in Table 1-7, along with the corresponding front panel references.

Table 1-5. Leak Networks

FRONT PANEL DESIGNATION	LEAK NETWORK
LEAK A	
LEAK B	
LEAK C	
LEAK D	
LEAK D-1	



NOTE: Power cable, 16AM (WECO) or equivalent, requirements are 16–gauge solid tinned copper, 2 conductors. Max. cable length 250 ft.

Figure 2-1. Power Connections

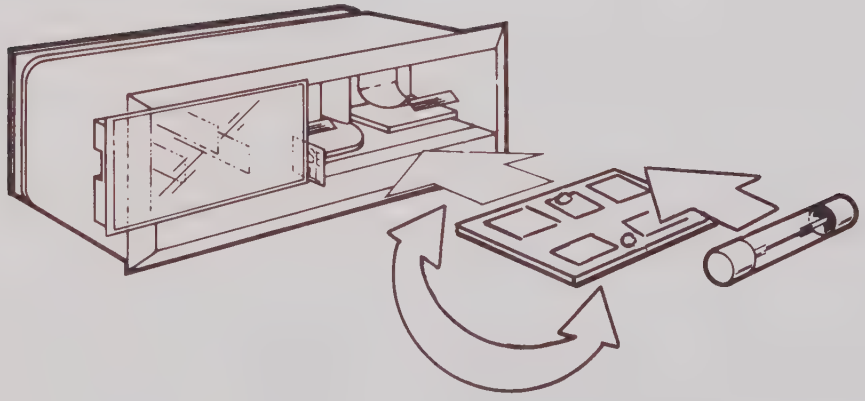


Figure 2-2. AC Voltage Selection

SECTION II

INSTALLATION

SECTION	CONTENTS	PAGE
2.	GENERAL.....	2-1
2.01	EQUIPMENT MOUNTING ...	2-1
2.02	POWER CONNECTIONS.....	2-1
2.03	AC POWER CONVERTER...	2-1
2.04	TO CHANGE VOLTAGE SETTING.....	2-1
2.05	FUSE RATING.....	2-1
2.06	INTERFACE CONNECTIONS	2-2

2. GENERAL

2.01 EQUIPMENT MOUNTING

The Signaling Test Set can be mounted in either a 19-inch or 23-inch rack. The rack ears are reversible to fit the rack size being used. In addition, the rack ears can be attached at the sides of the test set so that the unit can be flush-mounted or set forward 5 inches from the rack frame. Figure 2-4 is an outline drawing for the portable instrument with options. Figure 2-5 is the outline drawing for the rack-mounted version, including the options.

2.02 POWER CONNECTIONS

DC Power Connections

The dc power input to the Signaling Test Set is connected to the screw terminals at the left rear of the unit, as shown in Figure 2-1. Alternate dc power to the Signaling Test Set is through a 310 jack on the side panel, with -48 volts on the tip and battery return on the sleeve.

AC Power Connection

AC power operation is provided with Option 9. Ensure that 115V or 230V ac is selected as described in paragraph 2.04.

CAUTION

When the Test Set is operated from the AC Power Supply, a connection to office ground is required from the dc GND binding post for proper E&M operation.

2.03 AC POWER CONVERTER OPTION

Check that the ac voltage range is set for the line voltage. The ac voltage setting can be seen through the window on the rear panel of the test set. The window is shown in Figure 2-2 opposite.

2.04 HOW TO CHANGE THE AC VOLTAGE RANGE SETTING

Referring to Figure 2-2, perform the following:

1. Open cover door and move fuse-pull to left.

2. Orient the PC module so that it shows the voltage required. Insert into module slot.

3. Return fuse-pull to normal position. Insert fuse into holders.

2.05 FUSE RATING

For 115V ac, use a 1.5A fuse. For 230V ac, use a 0.75A fuse.

2.06 INTERFACE CONNECTIONS

Figure 2-3 gives the functions and wire colors for the Input Connector J1. For a mating connector, order WILTRON P/N 9454-1, 24-pin connector with 10-foot cable. Tables 2-1 and 2-2 list the functions and wire colors for No. 2 and No. 3 EAX offices, respectively.

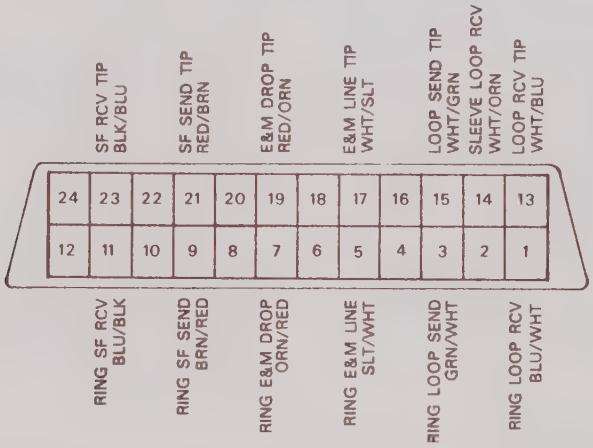

SF RCV TIP BLK/BLU
SF SEND TIP RED/BRN
E&M DROP TIP RED/ORN
E&M LINE TIP WHT/SLT
LOOP SEND TIP WHT/GRN
SLEEVE LOOP RCV WHT/ORN
LOOP RCV TIP WHT/BLU
24 23 22 21 20 19 18 17 16 15 14 13
12 11 10 9 8 7 6 5 4 3 2 1
RING SF RCV BLU/BLK
RING SF SEND BRN/RED
RING E&M DROP ORN/RED
RING E&M LINE SLT/WHT
RING LOOP SEND GRN/WHT
RING LOOP RCV BLU/WHT

Figure 2-3. Connections to Input Connector J1

Table 2-1. No. 2 EAX MTC Manual Test Position Cabling Frame TBK Wiring*

E&M			
Automatic Electric Terminal Block 3 Pin No.	E&M Function	Connector J1 Pin No.	WILTRON 9454-1 Cable Wire Color
H1	Line M Lead	5	SLT/WHT
H3	Line E Lead	17	WHT/SLT
H5	Drop M Lead	7	ORN/RED
H7	Drop E Lead	19	RED/ORN
LOOP			
Automatic Electric Terminal Block 2 Pin No.	Loop Function	Connector J1 Pin No.	WILTRON 9454-1 Cable Wire Color
F7	Tip (Send)	15	WHT/GRN
F8	Ring (Send)	3	GRN/WHT
F9	Tip (Receive)	13	WHT/BLU
F10	Ring (Receive)	1	BLU/WHT

*Reference: Automatic Electric Drawing No. EL-15015-058 and EL-15015-040

Table 2-2. No. 3 EAX Manual Test Position Cabling Frame TBK Wiring

E&M

Automatic Electric Terminal Block & Pin No.	E&M Function	Connector J1 Pin No.	WILTRON 9454-1 Cable Wire Color	Lead Name
Ø1 9F Ø5 H1	Line M Lead	5	SLT/WHT	DP RECEIVER TST M TST LINE
Ø1 F1Ø Ø5 H2	Line E Lead	17	WHT/SLT	DP SENDER TST E TST LINE
Ø5 H3 Ø H4	Drop E Lead Drop M Lead	19 7	RED/ORN ORN/RED	E TST DROP M TST DROP

LOOP

Automatic Electric Terminal Block 5 Pin No.	Loop Function	Connector J1 Pin No.	WILTRON 9454-1 Cable Wire Color	Lead Name
K6	Tip Loop SND	15	WHT/GRN	T LOOP SND
K7	Ring Loop SND	3	GRN/WHT	R LOOP SND
K8	T1 Loop RCV	13	WHT/BLU	T LOOP RCV
K9	R1 Loop RCV	1	BLU/WHT	R LOOP RCV
	S1 Loop RCV	14	WHT/ORN	

SF

Automatic Electric Terminal Block 5 Pin No.	S. F. Function	Connector J1 Pin No.	WILTRON 9454-1 Cable Wire Color	Lead Name
J1 J6	T SF SND	21	RED/BRN	T SF TO LINE T1 SF TO DROP
J2 J7	R SF SND	9	BRN/RED	R SF TO LINE R1 SF TO DROP
J3 J8	T1 SF RCV	23	BLK/BLU	T1 SF FROM LINE T SF FROM DROP
J4 J9	R1 SF RCV	11	BLU/BLK	R1 SF FROM LINE R SF FROM DROP

NOTE

For normal MTP's without the ATAS option, only TB-Ø1 connections to the E&M line are necessary for all DP testing.

For ATAS-equipped MTP's, both the TB-Ø1 and TB-Ø5 connections shown in Table 2-2 are necessary.

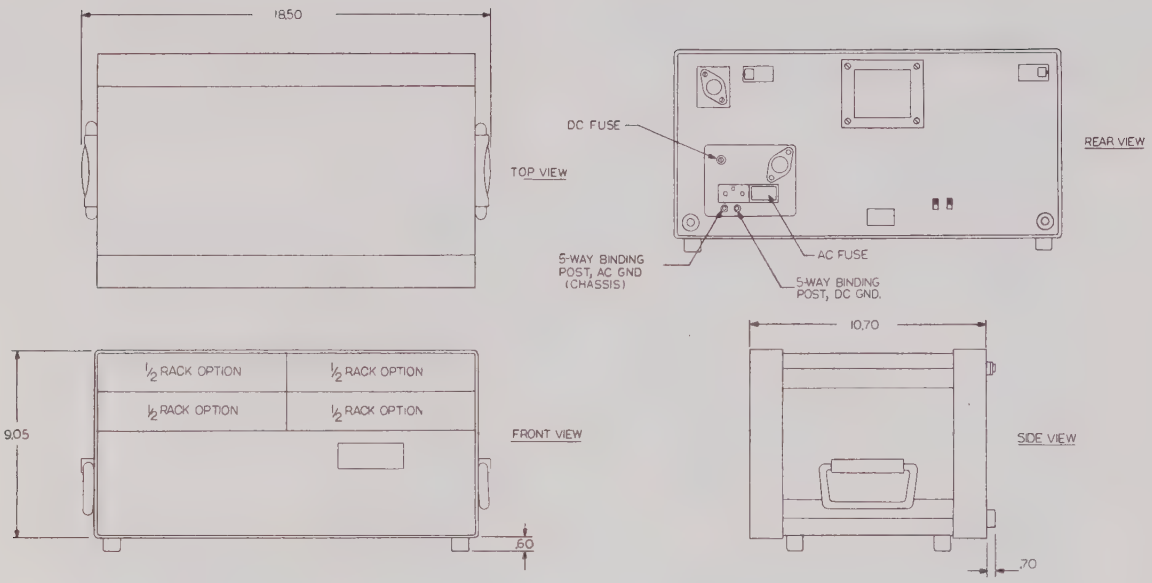


Figure 2-4. Outline Drawing, 9361B Portable Version, Option 2-5 (Four 1/2-Rack Options)

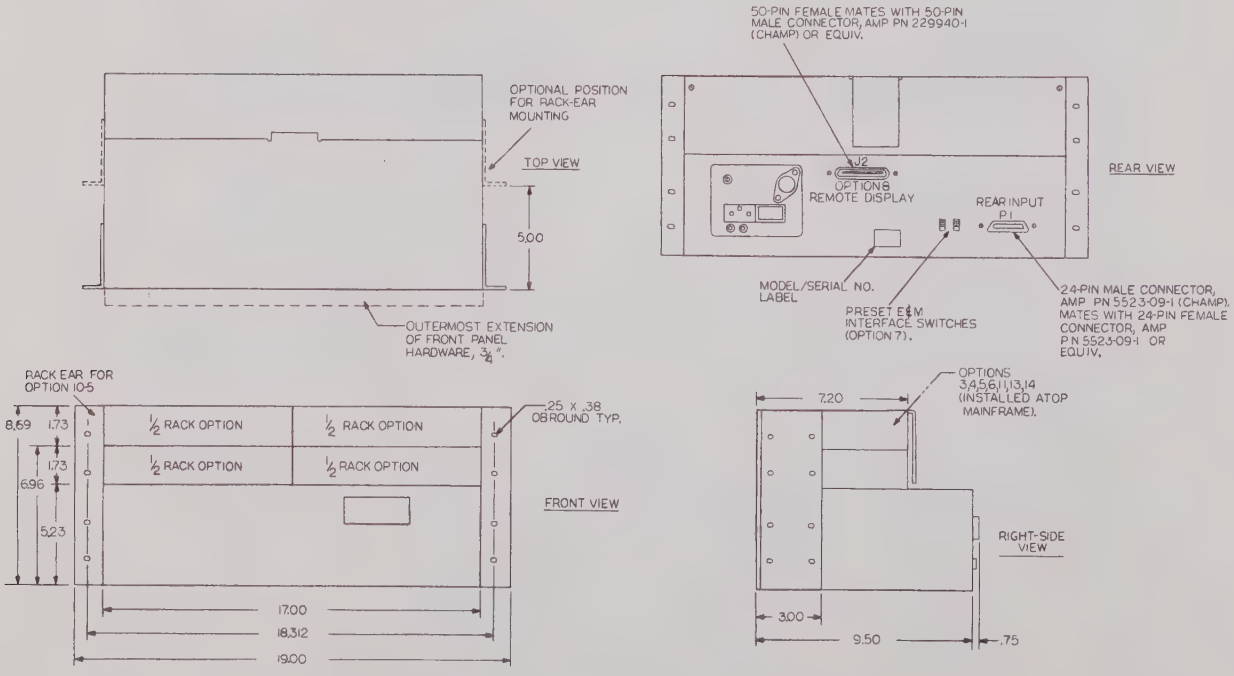


Figure 2-5. Outline Drawing, 9361B Rack-Mounted Version, Option 10-5 (Four 1/2-Rack Options)

SECTION III

FUNCTION OF CONTROLS, INDICATORS, AND CONNECTORS

SECTION CONTENTS PAGE

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3.01 FUNCTION OF CONTROLS, INDICATORS, AND CONNECTORS 3-1

3. GENERAL

3.01 FUNCTION OF CONTROLS, INDICATORS, AND CONNECTORS

Table 3-1 describes the function of the front panel controls, indicators and connectors for the standard equipment. Table 3-2 gives the same information for the options.

Table 3-1. Function of Controls, Indicators, and Connectors (Standard)

E& M Switches and Connectors:

LINE jack: Connects the sender and the receiver toward the LINE of the signaling circuit. The Tip connects to the E Lead and the Ring to the M lead.

DROP jack: Connects the sender and the receiver toward the DROP of the trunk circuit. The Tip connects to the E Lead and the Ring to the M Lead.

SUPV LINE indicator: Lights when Line is idle (i.e., E Lead is open).

SUPV DROP indicator: Lights when Drop is idle (i.e., M Lead is grounded).

MON SUPV THRU: Selects a high-impedance through path mode to determine if the circuit is idle.

CKT SPLIT Switches:

TWD LINE: Connects the sender output to the M Lead of the LINE jack. Terminates receivers into a low impedance.

TWD DROP: Connects the sender output to the E Lead of the DROP jack. Terminates receivers into a low impedance.

NOTE

If neither the RCV FROM LINE nor DROP pushbutton is selected, the signal received is determined by the CKT SPLIT pushbutton selected (i.e., if neither of the RCV FROM pushbuttons is selected, you receive from the jack that is selected for sending).

Table 3-1. Function of Controls, Indicators, and Connectors (Continued)

SEND Switches:

ON HK: Provides an on-hook to the circuit under test.

OFF HK & DIAL: Provides an off-hook condition, or dial pulses as selected by the keypad, to the circuit under test.

PULSE: Applies continuous pulses to the circuit under test, as controlled by the SEND PPS and SEND % BREAK switches.

INTERFACE TYPE: Internally reconfigures the LINE and DROP jacks to one of four E&M Interface types. The selected type depends on the particular office or equipment being tested.

RCV FROM Switches:

LINE: When in the bridging mode, measures on the E Lead with a high impedance. When in the circuit split mode, measures on the E Lead of the LINE jack with a low impedance. See note above.

DROP: When in the bridging mode, measures on the M Lead with a high impedance. When in the circuit split mode, measures on the M Lead of the DROP jack with a low impedance. See note above.

REV SUPV Switches:

ON HK:
OFF HK: } When in the circuit split towards Line mode, provides an ON HK or OFF HK towards the Drop. When in the circuit split towards Drop mode, provides ON HK or OFF HK towards the Line. The ON HK or OFF HK mode provided depends on the INTERFACE TYPE selected.

LOOP/B&G Switches and Connectors:

SEND jack: Connects the Loop under test to the sender.

CKT IDLE indicator: Lights when the Loop under test is idle (battery on the Ring, ground on Tip of jack).

RCV jack: Connects the Loop under test to the receiver.

SLEEVE GND indicator: Lights to show when the sleeve has been grounded by the office equipment.

ON HK: Provides an on-hook (open loop) to the circuit under test.

OFF HK & DIAL: Provides an off-hook condition or dial pulses, as selected by the keypad, to the circuit under test.

Table 3-1. Function of Controls, Indicators, and Connectors (Continued)

PULSE: Applies pulses to the circuit under test, as controlled by the SEND PPS and SEND % BREAK switches.

GND START: Applies a momentary ground on the Ring connection to make a service request on PBX trunks.

SEND LOOP RES: Five pushbuttons select the Send Loop resistance over a 100 to 1600-ohm range in 100-ohm steps.

SEND LEAK NETWORK: Provides selection of the A, B, C, D, or D-1 Send Leak Networks.

RCV INPUT:

T/R REV: Reverses Tip and Ring connections of RCV jack. The receiver presents BATT on Ring and GND on Tip in the normal position (i.e., T/R REV switch not pressed in).

BRDG: Connects the Loop under test to a balanced 20kΩ bridging impedance.

TERM: Connects Loop under test to a balanced 400Ω impedance.

S-R: Connects the Loop under test to a measuring circuit to measure from dry contacts on pulsing relays, without the indicated % Break reading being affected by contact protection, Loop, or Leak circuits present.

A-RELAY: Connects the Loop under test to the internal A-Relay.

RECEIVE Switches:

E&M: Selects the E&M functions for receiving from either Line or Drop.

LOOP/B&G: Selects Loop/B&G RCV jack functions for connection to the receiver.

SF/DX: Selects the optional SF or DX panel for connection to the receiver.

MON SEND: Measures and displays the sender output.

RECEIVE ON HK indicator: Lights when an ON HOOK pulse is being received. The indicator flashes at the received input pulse rate.

DISPLAY Switches:

PPS: Selects the pulses per second (PPS) display of the received signal.

% BRK: Selects the percent break (% BRK) display of the received signal. Indicates the average percent break.

Table 3-1. Function of Controls, Indicators, and Connectors (Continued)

FIRST PULSE: Selects the % BRK display of the first pulse pair received to check for the difference with the average percent break reading from the previous paragraph.

COUNT PULSES: Selects a display of the dialed digits received. This is used to check for dropped or split pulses and to note the dialed number.

SEND Switches:

E&M: Selects the E&M functions for sending to either the Line or Drop.

LOOP: Selects the Send Loop functions.

B&G: Selects the B&G functions for Send Loop operation.

SF/DX: Connects the sender to the optional SF or DX panel.

SEND Indicator: Lights when the pulse being sent is ON HOOK. The indicator flashes at the send pulse rate.

SEND PPS Switches:

8, 10, 12: Provide selection of fixed preset speeds of 8, 10, or 12 PPS.

MEM: Provides selection of a send speed between 0.1 and 29.9 PPS in 0.1 PPS steps, as selected on the keypad. The initial value provided is 20 PPS.

STORE: Operates in conjunction with the MEM pushbutton to obtain a desired PPS speed. Initially, forces the display to show the present value of the SEND PPS MEM pushbutton. The keypad can then be used to enter a different value if desired (see Table 5-1).

SEND % BREAK Switches:

58, 64: Provide selection of fixed preset percent break values of 58 or 64. With Option 21: 60.5, 68.5%. With Option 22: 40, 70%. With Option 23: 60.5, 68.5%.

MEM 1, MEM 2: Provide selection of any two percent break values between 0.1 and 99.9% in 0.1 steps, as selected on the keypad. The initial values provided are 49% for MEM 1, 73% for MEM 2. With Option 21: 55, 70%. With Option 22: 58, 66%. With 23: 58, 64%.

STORE: Same as for SEND PPS, except used with MEM 1 and MEM 2.

Table 3-1. Function of Controls, Indicators, and Connectors (Continued)

STORE INTER-DIGITAL TIME (ms):

When selected, forces the display to show the present value of the inter-digital time in milliseconds. The keypad can then be used to enter a different value, if desired (see Table 5-4). Initial value is 650 milliseconds.

KEYPAD: Provides standard dial operation. Also permits DIAL INTO MEMORY button to store up to 13 digits and outpulse them on command (OUTPULSE FROM MEMORY key). The keypad is also used for changing the SEND PPS MEM, SEND % BREAK MEM 1 and MEM 2, and INTER-DIGITAL TIME values.

DC POWER INPUT: -48V dc input for Model 9361B, either through an input jack on the side panel, or through terminal strip TB1 on the rear panel (if Option 9, Power Converter, is not present).

REAR INPUT: P1 (Rack Model only) for cordless access in test board systems and for jack multiples is detailed in Section II, 2.06. The connection is cut off when a jack is inserted on the front panel.

Table 3-2. Model 9361B Options: Function of Controls and Indicators

SF: (Option 5)

CKT IDLE Indicator: Lights when an SF tone is being received at the SF RCV jack.

RCV OVERLOAD Indicator: Lights when an SF level greater than 0 dBmO is applied to the SF RCV jack.

MON BRDG: Monitors SF receive circuits on a bridging basis. Also for signaling measurements (on a bridging basis) on SF traffic.

TLP:

LINE: Provides Send level for a -16 dBm TLP, with level coordinated for an SF Receive level of +7 dBm TLP.

DROP: Provides Send level for a +7 dBm TLP, with level coordinated for an SF Receive level of -16 dBm TLP. Refer to Tables 6-11 and 6-12 for other TLP values.

SEND:

ON HK: Provides a -20 dBmO SF tone to the SF SEND jack.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

OFF HK & DIAL: Provides an OFF HK level (no tone) to the SF SEND jack. Any number entered into the keypad will be transmitted at the PPS, % BRK, and IDT selected, at a -8 dBmO pulsing level. Any number stored in the dial memory can be outpulsed.

PULSE: Provides a -8 dBmO SF Send level to the SF SEND jack. The PPS and % BRK are as selected.

dB BELOW SEND TLP: Indicator lights when set off zero position. Provides a means of reducing the SF Send level from 0 to 12 dB from that selected.

EXT OSC Jack: A bantam plug inserted in the jack disables the internal 2600 Hz oscillator. An external oscillator may be connected to provide other than a 2600-Hz SF tone. The external oscillator level should be 0 dBm from 600 ohms to provide the standard SF levels.

ARTIFICIAL TRUNK: (Option 6)

LOOP CURRENT mA: Used to measure the dc current in the external loop or artificial trunk, depending upon switch selection.

ART RES: Adjusts artificial loop resistance to set artificial loop current from the WILTRON A-Relay equal to the external loop current.

ART TRUNK MEASURE:

LOOP mA: Connects LOOP CURRENT mA meter to the external loop being measured.

ART mA: Connects LOOP CURRENT mA meter to measure artificial trunk current as set by ART RES control.

ART TEST: Used for pulsing measurements on a local basis with the external trunk connected to the Send circuit of the Loop/B&G circuit.

OFF: Switches artificial trunk panel out of the loop circuit.

TALK/LISTEN: (Option 3 or part of Option 4)

LOOP/B&G TALK LISTEN SEND CKT: Connects 2-Wire handset (plugged into TEL SET jack) to LOOP/B&G SEND circuit for Talk/Listen capability.

SF LISTEN RCV CKT: Connects 2-Wire handset (plugged into TEL SET jack) to SF RCV circuit to listen for tone.

TEL SET: Type 310 jack used to connect 2-Wire handset for Talk/Listen capability.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

SEND REMOTE CONTROL: (part of Option 4)

NORMAL: Provides normal use of all front panel controls on the Model 9361B.

REMOTE CONTROL: Enables control of the sender using the hand-held Controller unit.

CONTROLLER: Connector for attaching the cable to the Remote Control Unit.

CONTROLLER 9361B-4C: (part of Option 4)

ON HK, OFF HK & DIAL, PULSE: Three-position switch.

In the ON HK position, provides an on-hook to the circuit under test.

In the OFF HK & DIAL position, provides an off-hook condition to the circuit under test.

In the PULSE position, applies continuous pulses to the circuit under test, as selected by the momentary switches MEM 1 % BRK or MEM 2 % BRK.

LEAK: Connects the SEND LEAK NETWORK only (as selected on the 9361B front panel) to the Loop circuit under test.

LOOP: Connects the SEND LOOP RES only (as selected on the 9361B front panel) to the circuit under test.

MEM 1 % BRK: Selects the % Break value stored for MEM 1 and SEND PPS MEM.

MEM 2 % BRK: Selects the % Break value stored for MEM 2 and SEND PPS MEM.

DIAL: If the momentary MEM 1 or MEM 2 position selected is pressed again when the 3-position switch is in the OFF HK & DIAL position, the number stored in the 9361B memory will be re-dialed.

PRESET E&M INTERFACE: (Option 7)

These switches replace the internal preset switches, allow selection of the required E and M lead states from the rear panel. Adds a state, allowing the M-lead to switch between ground and open or battery and ground for ON- and OFF-HOOK.

REMOTE DISPLAY OUTPUT: (Option 8)

Output connector J2 for the remote display units. This output is in BCD format.

AC POWER CONVERTER: (Option 9 or 9A)

Allows the Model 9361B portable version to operate from 115 or 230V ac, or -48V dc. Option 9A is supplied when three or four half-rack options are ordered.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

MF/DTMF COMM PANEL: (Option 13)

SEND MODE switches:

DIAL PULSE: Selects standard dial pulses as the output from the instrument for digits dialed on the SEND keypad or for continuous pulses. Applies to Loop/B&G, E&M, SF, and DX as selected.

DTMF: Selects DTMF tones as the output from the instrument for digits dialed on the SEND keypad.

MF: Selects MF tones as the output (including ST and KP) from the instrument for digits dialed on the SEND keypad.

NOTE

No continuous pulses can be sent if DTMF or MF is selected, regardless of the setting of the PULSE pushbutton on any other panel.

SEND MODE indicator: Lights when the DTMF or MF send mode is selected. This indicator alerts the craftsperson that the 9361B is sending MF or DTMF tones, rather than dial pulses, to the circuit under test.

APPLICATION switches:

OFF: Puts the 9361B in its Pulse Signaling Mode. Disconnects the Talk and TMS circuits of the COMM PANEL from the signaling circuit when normal signaling tests are to be made.

NOTE

To prevent pulse-signaling distortion, the APPLICATION - OFF pushbutton must be pushed when the MF/DTMF dialing, Talk, and TMS circuits are not in use.

LOOP SEND: Connects the MF/DTMF dialing and Talk/TMS circuits to the 9361B Loop SEND jack.

SF/DX: Connects the MF/DTMF dialing and Talk/TMS Circuits to the SF or DX jacks, depending on which adapter option the 9361B is equipped with. If the 9361B is equipped with both Options 5 and 14, the connection depends on the DX ACTIVE switches selected -- refer to the description of the DX Adapter controls and indicators.

APPLICATION indicator: Alerts the craftsperson when the MF/DTMF dialing and Talk/TMS circuits are connected to the 9361B Loop/B&G circuits or to the SF/DX Adapter.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

NOTE

Pulses will be severely distorted if they are sent when the APPLICATION - LOOP SEND or - SF/DX button is pushed.

TMS jacks:

SEND: 310 jack used to connect an external oscillator in order to send tone on the circuit being tested.

NOTE

For accurate results, the oscillator must be set to 600 ohms output impedance for both 2-wire and 4-wire tests.

The oscillator output appears at one of several jacks:

LOOP SEND: Used for 2-wire tests. The oscillator output impedance is converted to 900 ohms from 600 ohms automatically without any level change.

SF Adapter (Option 5) SEND: Used for 4-wire tests. When Split To Line is selected, 16 dB of attenuation is applied to the oscillator output. When Split-to-Drop is selected, +7 dB of gain is added to the oscillator output. These levels can be attenuated up to 12 dB with the SEND ATTN- 0dB control.

DX Adapter (Option 14) TO FAR DX SET: Used to send tone over 2- or 4-wire DX circuits. For 2-wire DX circuits, the oscillator output appears at the top left (Split-to-Far-DX) and top right (Split-to-Near DX) jacks.

For 4-wire DX circuits, the oscillator output appears at the top left jack (Split-to Far-DX) and the bottom right jack (Split-to-Near-DX).

RCV: 310 jack is used to connect an external level/noise meter for transmission tests on 2- and 4-wire circuits.

NOTE

For accurate readings, the TMS must be set to 600 ohms send and receive for both 2-wire and 4-wire tests.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

The TMS RCV jack receives its signals from one of several jacks:

LOOP SEND: Used for 2-wire measurements. The 600-ohm level/noise meter is converted to 900-ohm impedance automatically for 2-wire tests.

SF Adapter (Option 5) RCV: Used for 4-wire measurements. When Split to Line is selected, a 7 dB attenuator is inserted ahead of the level/noise meter. This means that all dBm and dBrn readings will be 7 dB low. When Split to Drop is selected, a 16 dB amplifier is inserted ahead of the level/noise meter. This means that all dBm and dBrn readings will be 16 dB high.

DX Adapter (Option 14) jacks: Used to measure level and noise on 2- and 4-wire DX circuits. On 2-wire DX circuits, the level/noise input is from the top left jack (when Split-to-Far DX) and the top right jack (when Split-to-Near DX).

On 4-wire DX circuits, the level/noise input is from the bottom left jack (when Split-to-Far DX) and from the top right jack (when Split-to-Near DX).

HEADSET jacks: Send/receive dual tip/sleeve jacks for a standard 4-wire headset for talking on the selected 2- or 4-wire Talk circuit. Sidetone is provided.

DX PANEL: (Option 14)

2W/4W connection jacks: 310 (or optional bantam) jacks used to connect the DX circuit under test.

TO NEAR DX SET: The right-hand pair of jacks provides the connection point to the adapter from the near DX circuit under test. The top right jack is the connection point for 2-wire circuits and for receiving from 4-wire circuits. The bottom right jack is the connection point for transmitting into 4-wire circuits. The Model 9361B provides an artificial line for near-end measurements. The circuit-loading values of this line are selected by the LINE RESISTANCE & RELAY BALANCE pushbuttons.

TO FAR DX SET: The left-hand pair of jacks provides the connection point to the adapter from the far DX circuit under test. The top left jack is the connection point for 2-wire circuits and for transmitting into 4-wire circuits. The bottom left jack is the connection point for receiving from 4-wire circuits.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

NOTE

As indicated by the jack label, for 2-wire DX circuits, the A lead is derived from the plug "RING." For 4-wire DX circuits, the A leads are derived from bottom <—— jacks, and the B leads are derived from the top ——> jacks. (Refer to the A/B REV switch description.)

MON THRU switch: Bridges the 9361B high impedance DX Receiver across the 2- or 4-wire circuit under test. Connects the TO FAR DX SET and TO NEAR DX SET jacks together on both 2- and 4-wire DX circuits to prevent splitting the circuit on test.

CKT SPLIT switches:

TWD FAR DX: Splits the circuit under test toward the far end (artificial line is not in circuit).

TWD NEAR DX: Splits the circuit under test toward the near end (artificial line is now present).

SEND switches:

ON HK: Provides an on-hook condition to the section, as selected by CKT SPLIT.

OFF HK AND DIAL: Provides an off-hook condition or dial pulses, as selected by the keypad on the mainframe, to the direction selected by CKT SPLIT.

PULSE: Applies continuous DX 2W or 4W pulses, controlled by the SEND PPS and SEND % BREAK switches, to the section selected by CKT SPLIT of the circuit under test.

4 WIRE switch: Selects the 4-wire DX circuit operating mode of the DX Adapter. When the pushbutton is released, 2-wire DX operating mode is selected.

A/B REV switch: Interchanges the A and B Leads to the WILTRON DX Receiver, reverse circuit supervision circuit, and the polar relay.

REV SUPV ON HK switch: Provides an off- or on-hook condition to the opposite direction to that selected by CKT SPLIT of the circuit under test.

DX ACTIVE switches:

SEND: Routes pulses or tones for transmission to the DX circuit under test from the SEND panel.

Table 3-2. Model 9361B Options: Function of Controls and Indicators (Continued)

NOTE

This button must be pushed in for the DX panel to send pulses. If the button is out and SEND SF/DX is selected, SF pulses will be sent.

RCV: Routes pulses or tones received from the DX circuit under test to the RECEIVE panel.

NOTE

This button must be pushed in for DX to be measured. If the button is out and RECEIVE SF/DX is selected, SF pulses will be received.

SUPV CKT IDLE indicator: Lights when the circuit under test is idle, or flashes when being pulsed. This indicator is used on split circuits only.

NOTE

If the A and B leads of the circuit under test are reversed, this indicator will operate in reverse and will light when an off-hook signal is received.

LINE RES & RELAY BALANCE switches: Selects values of resistance and capacitance to match the impedance of the DX circuit under test. Resistance switches may be selected individually or in any combination. For example, to match a line resistance of 1200 ohms, press 800 and 400. No resistance is added to the circuit if all the LINE RES buttons are released.

NOTE

The normal 1240-ohm resistance of the polar relay is provided in the WILTRON panel. Resistances selected by the pushbuttons are in addition to the 1240 ohms.

Capacitance values may also be selected individually or in any combination. The capacitance values available are as follows:

1. 3μf	both pushbuttons released
2. 0μf	2μf selected
4. 0μf	4μf selected
6. 0μf	2μf and 4μf selected

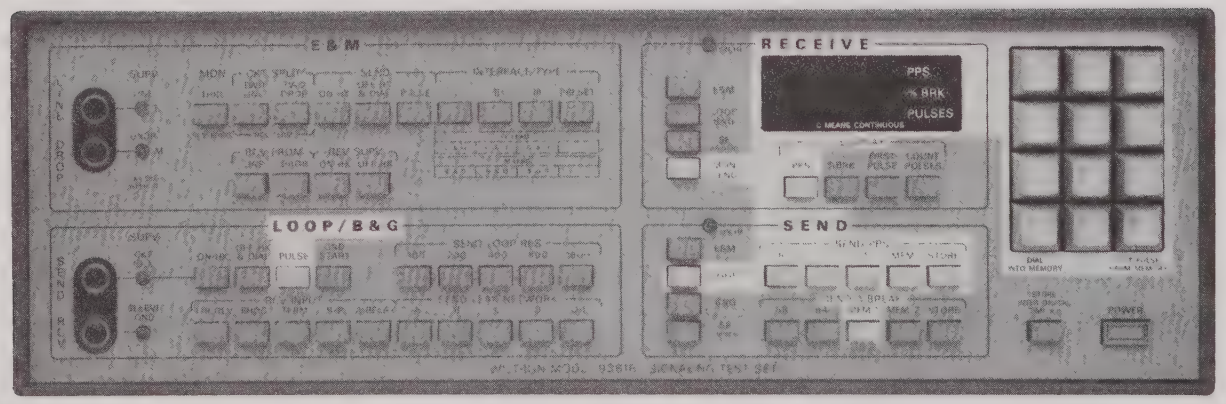

Figure 4-1. Verify SEND PPS

SECTION IV

PERFORMANCE VERIFICATION

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4.01 GENERAL

When power is first applied, a number representing the software revision is displayed. The unit then performs a self-check, and displays "0" when this is successfully completed. Any number other than "0" displayed indicates a power or equipment fault.

4.02 PERFORMANCE VERIFICATION PROCEDURES

The following tables contain procedures that enable the operator to verify that the Model 9361B Signaling Test Set is functioning properly. If the equipment is not performing as described, go to Section VIII, Troubleshooting.

Table 4-1. Verify SEND PPS

STEP	PROCEDURE
1	Select the switches shown in Figure 4-1: SEND % BREAK: MEM 1 SEND: LOOP LOOP/B&G: PULSE RECEIVE: MON SEND DISPLAY: PPS
2	Select the following switches in turn: SEND PPS: 8, 10, 12, and MEM and check that the display reads within ±0.2 of 8.0, 10.0, 12.0, and 20.0 respectively.
3	With SEND PPS: MEM selected, press and hold down SEND PPS: STORE. The display now shows the stored PPS value. Use the keypad to store a new PPS value by pressing 1-2-5. A Value of 12.5 PPS is now stored in SEND PPS: MEM. Release the SEND PPS: STORE pushbutton. The sender output is now changed to the new value. Check that the display reading is 12.5 ±0.2 PPS.

Table 4-2. Verify SEND % BREAK

STEP	PROCEDURE
1	Select the switches shown in Figure 4-2: SEND PPS: 12 SEND: LOOP LOOP/B&G: PULSE RECEIVE: MON SEND DISPLAY: % BRK
2	Select the following switches in turn: SEND % BREAK: 58, 64, MEM 1 and MEM 2 and check that the display reads within ±0.2 of: 58.0, 64.0, 49.0, and 73.0 respectively. NOTE If Option 21, 22, or 23 is provided, see page 1-5 for corresponding values.
3	With the SEND % BREAK: MEM 2 selected, press and hold down SEND % BREAK: STORE. The display now shows the stored % BREAK value in MEM 2. If different values are required, use the keypad to store a new % BREAK value. For example, pressing 4-5-6 will store a value of 45.6 in SEND % BREAK: MEM 2. Release the SEND % BREAK: STORE pushbutton. The sender output is now changed to the new value. Check that the display reading is 45.6 ±0.2% BRK.

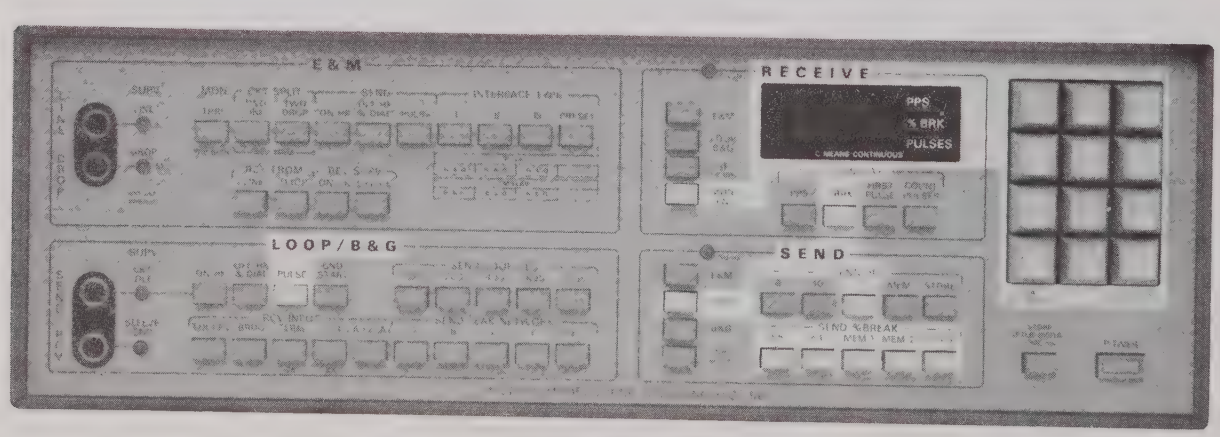

Figure 4-2. Verify SEND % BREAK

Table 4-3. Verify SEND and RECEIVE ON HK Indicators

STEP	PROCEDURE
1	Select the switches shown in Figure 4-3: SEND PPS: 12 SEND % BREAK: 58 SEND: LOOP RECEIVE: MON-SEND
2	Select LOOP/B&G: ON HK. This puts the sender output in the ON HOOK mode. Check that the SEND ON HK and the RECEIVE ON HK indicators are lit.
3	Select LOOP/B&G: OFF HK & DIAL. This puts the sender output in the OFF HOOK mode and ready to dial from the keypad. Check that the SEND ON HK and the RECEIVE ON HK indicators are OFF.
4	Select LOOP/B&G: PULSE The sender output is now pulsing continuously at the selected SEND PPS and % BREAK settings. Check that the SEND ON HK and RECEIVE ON HK indicators are flashing.

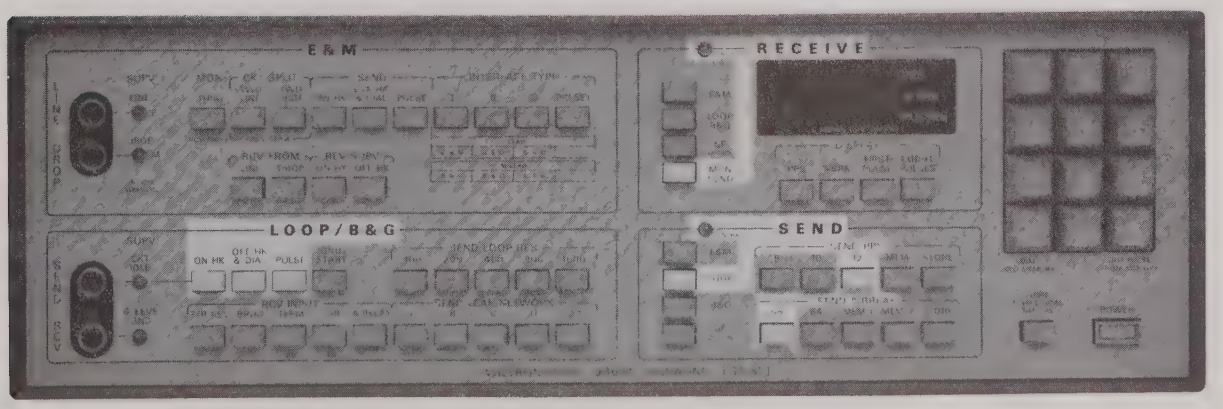

Figure 4-3. Verify SEND and RECEIVE ON HK Indicators

Table 4-4. Verify DIALING

STEP	PROCEDURE
1	Select the switches shown in Figure 4-4: SEND PPS: 12 SEND % BREAK: 58 SEND: LOOP LOOP/B&G: OFF HK & DIAL RECEIVE: MON SEND DISPLAY: COUNT PULSES
2	On the keypad press momentarily 7, 8, 9, and 0 in turn. This causes the sender output to dial the digits 7, 8, 9, and 0 at the selected SEND PPS, % BREAK and INTER-DIGITAL TIME. Check that the display indicates the correct number after each digit is dialed. (Observe that a digit 0 corresponds to 10 pulses.)

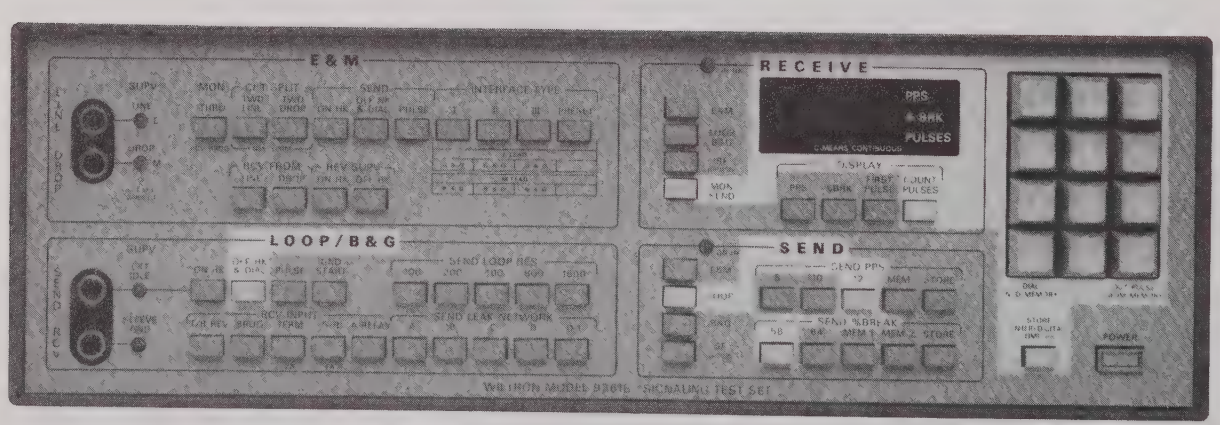

Figure 4-4. Verify DIALING

Table 4-5. Verify DIAL INTO MEMORY

STEP	PROCEDURE
1	Select the switches shown in Figure 4-5: SEND PPS: 12 SEND % BREAK: 58 SEND: LOOP LOOP/B&G: OFF HK & DIAL RECEIVE: MON SEND DISPLAY: COUNT PULSES
2	On the keypad momentarily press DIAL INTO MEMORY (the * pushbutton of the keypad). Up to 13 digits can be dialed into memory for later recall by OUTPULSE FROM MEMORY (the # pushbutton of the keypad). On the keypad momentarily press 1, 2, 3, 4, 5 and 6 in turn. The number 123456 is now stored in memory.
3	On the keypad momentarily press OUTPULSE FROM MEMORY (the # pushbutton of the keypad). This causes the sender output to dial from memory the previously-stored number at the selected SEND PPS, % BREAK and INTER-DIGITAL TIME. Check that the display indicates the correct number after each digit is dialed. The stored number can be redialed, out of memory, as often as desired at various speeds and % breaks, just by pressing OUTPULSE FROM MEMORY (the # pushbutton of the keypad). NOTE The appropriate OFF HK & DIAL and SEND pushbuttons must be selected to dial to E&M, Loop, or B&G.

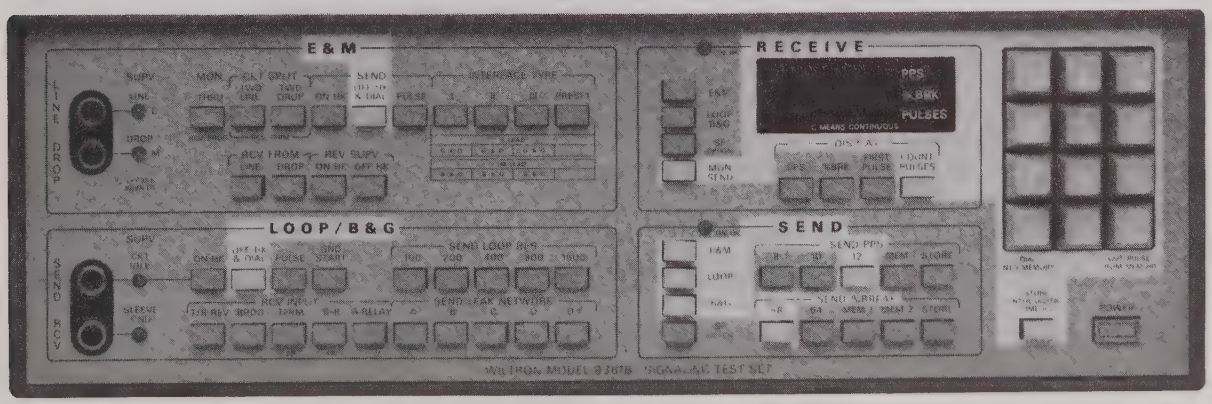

Figure 4-5. Verify DIAL INTO MEMORY

Table 4-6. Verify INTER-DIGITAL TIME

STEP	PROCEDURE
	NOTE Upon power application, INTER-DIGITAL TIME is preset to 650 ms.
1	Press and hold down the INTER-DIGITAL TIME pushbutton shown in Figure 4-6. The display now shows the present value of the inter-digital time that will be used by the instrument when sending dial pulses.
2	If a different value of Inter-Digital Time is desired, it is done by inserting the value with the keypad. While holding down the INTER-DIGITAL TIME pushbutton, use the keypad and press 3, 5 and 0 in turn. A new value of 350 ms has been stored by the instrument for use as the Inter-Digital Time.
	NOTE The sender output Inter-Digital Time can be set to any value between 1 and 999 ms. This setting does not change the receiver Inter-Digital Time. The incoming digits should have inter-digital times ≥300 ms for correct measurements.

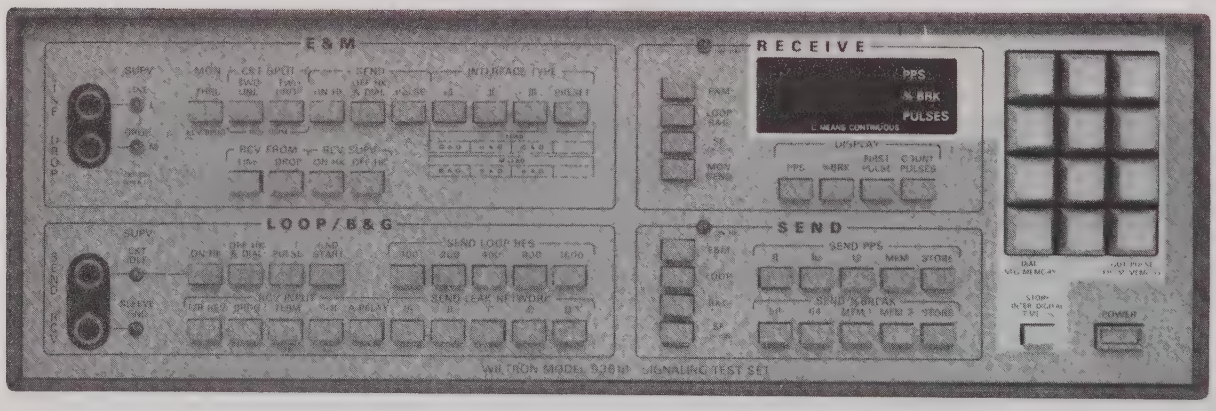

Figure 4-6. Verify INTER-DIGITAL TIME

Table 4-7. Verify the % BREAK of the Send Pulsing Relay

STEP	PROCEDURE
1	Select the switches shown in Figure 4-7: RECEIVE: MON SEND % BREAK LOOP: PULSE TERM SEND: B&G 12 PPS First SEND % BREAK button (58, 60.5) Check that the display reads the value selected.
2	Press the RECEIVE LOOP/B&G button. The display should read the % Break value selected ±0.2%.
3	If the value indicated is outside the tolerance of the value selected, go to the Maintenance section, paragraph 7.13.

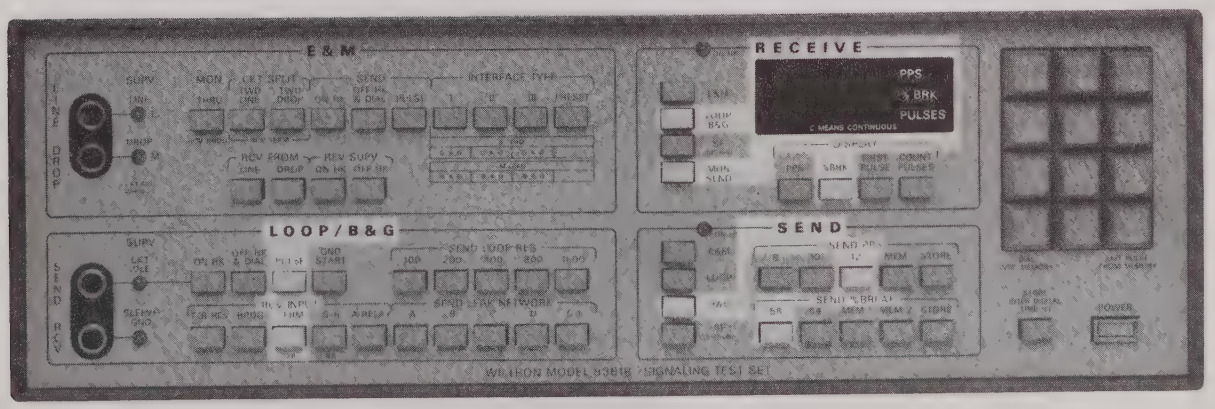

Figure 4-7. Verify the Send Pulse Relay % BREAK

Table 4-8. Verify E&M

STEP	PROCEDURE
1	Select the switches shown in Figure 4-8. SEND PPS: 12 SEND % BREAK: 58 (or 60.5 or 55 as applicable to your set) SEND: E&M E&M CKT SPLIT: TWD LINE RCV FROM: DROP SEND: ON HK REV SUPV: ON HK INTERFACE TYPE: I RECEIVE: E&M DISPLAY: % BRK
2	Patch a 310 to 310 cord from the E&M LINE jack to the E&M DROP jack. The E&M sender is now connected to the LINE jack (M lead of LINE) and sending an ON HK according to the Interface Type (ground on M lead for Type I). In the reverse direction (E lead of DROP), an ON HK is sent according to the Interface Type (open on E lead for Type I). Check that the E&M SUPV LINE and DROP indicators are lit, indicating ON HOOK.
3	Select E&M SEND: OFF HK AND DIAL. The E&M output now sends an OFF HOOK on the LINE jack (M lead of LINE) according to the Interface Type selected (battery on M lead for Type I). Check that the E&M DROP indicator is off, showing an OFF HOOK is being received on the DROP (M lead).
4	Select E&M REV SUPV: OFF HK. In the reverse direction (E lead of DROP), an OFF HOOK is sent according to the Interface Type (ground on E lead for Type I). Check that the E&M LINE indicator is off, showing an OFF HOOK is being received on the LINE (E lead).

(Continued on next page.)

Table 4-8. Verify E&M (Continued)

STEP	PROCEDURE
5	Select E&M SEND: PULSE. The E&M sender is outpulsing at the selected SEND PPS and SEND % BREAK settings. The pulses are going out at the LINE jack (M lead) and the measurement is performed on the pulses arriving at the DROP jack (M lead). The selected measurement (% Break) is displayed. Check that the pulses are being received, as indicated by the E&M SUPV DROP (M lead) indicator flashing. Check that the display indicates the measurement of 58.0 ±0.2% BRK (or 60.5 or 55 as applicable). NOTE If the AC Power Converter is equipped (Option 9) check the ground connections on the rear panel. See paragraph 2.04.

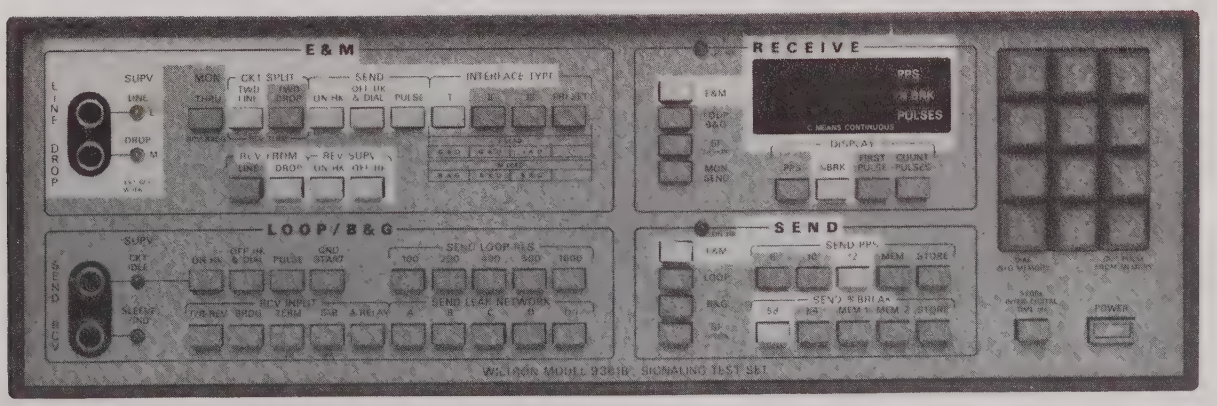

Figure 4-8. Verify E&M

Table 4-9. Verify LOOP/B&G

STEP	PROCEDURE
1	Select the switches shown in Figure 4-9. SEND PPS: 12 SEND % BREAK: 58 (or 60.5 or 55 as applicable) SEND: LOOP LOOP/B&G SEND: ON HK RCV INPUT: TERM T/R REV: OUT SEND LOOP RES: none SEND LEAK NETWORK: none RECEIVE: LOOP/B&G DISPLAY: % BRK
2	Patch a 310 to 310 cord from LOOP/B&G SEND jack to LOOP/B&G RCV jack. The sender output is now connected to the LOOP/B&G SEND jack and sending an ON HK (open). The LOOP/B&G RCV jack is receiving an ON HK from the SEND jack and is displayed on the RECEIVE ON HK indicator. With an idle receiver (Tip = ground, Ring = Batt) connected to the SEND jack, the circuit idle indicator will be lit. Check that the LOOP/B&G SUPV CKT IDLE indicator is lit, showing an idle receiver connected to the SEND jack. The sender should be in the ON HK mode for this indication. Check that the RECEIVE ON HK indicator is lit, showing an ON HOOK connected to the LOOP/B&G RCV jack.
3	Select LOOP/B&G SEND: OFF HK & DIAL. The sender output is now in the OFF HOOK mode (closed dry contacts for LOOP). Check that the RECEIVE ON HK indicator is off, showing an OFF HOOK connected to the LOOP/B&G RCV jack.

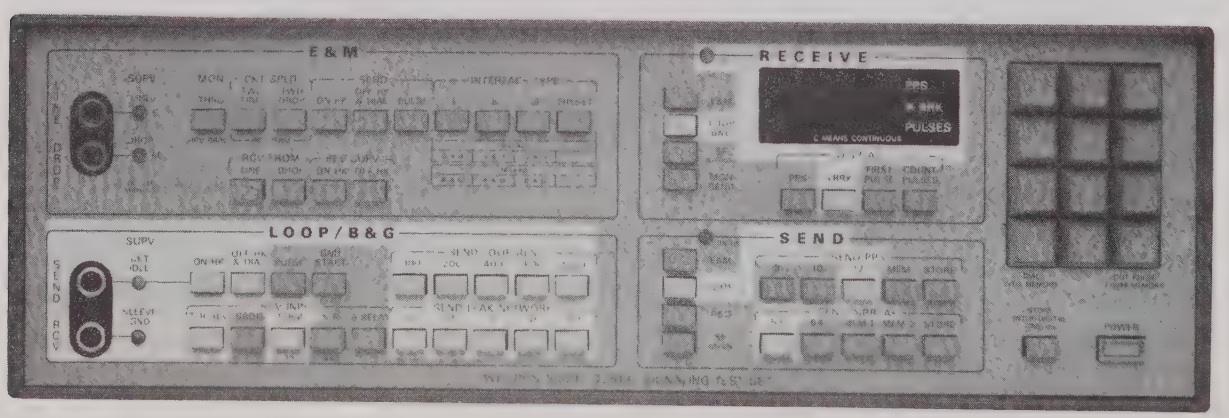

Figure 4-9. Verify LOOP/B&G

Table 4-10. Verify A-Relay

STEP	PROCEDURE
	NOTE This instrument has a built-in A-Relay that is accessed by selecting a front panel push-button. No external patch is required.
1	Select the switches shown in Figure 4-10. SEND PPS: 12 SEND % BREAK: MEM 1 SEND: LOOP LOOP/B&G SEND: PULSE SEND LOOP RES: as indicated below SEND LEAK NETWORK: as indicated below RCV INPUT: A-RLY T/R REV: Out RECEIVE: LOOP/B&G DISPLAY: % BRK
	NOTE If Option 9, AC Power Converter, is used, Step 2 can be skipped since the voltage is regulated to 48.0V dc.
2	Verify that the dc input voltage to the terminal block of the instrument is 48.0 ±0.1V. If not, the percent break reading of the A-Relay must be corrected for the effect of the voltage difference (see Figure 4-11).
3	Patch a 310 to 310 cord from the LOOP/B&G SEND jack to the LOOP/B&G RCV jack. The sender is now connected to the internal A-Relay.
4	Check the readings with the following conditions. (Enter 60.5 in MEM 1 and 68.5 in MEM 2 if not available on front panel. See Table 4-2.)

	PPS	% BREAK	LOOP RES	LEAK NETWORK	DISPLAY READING
a)	12.0	60.5	0	A	43.0 ±3.5
b)	12.0	68.5	1400	none	84.0 ±3
c)	12.0	60.5	1400	A	60.5 ±2

If any portion of this test is not met, then the A-Relay Adjustment Procedure has to be performed (see paragraph 7.01).

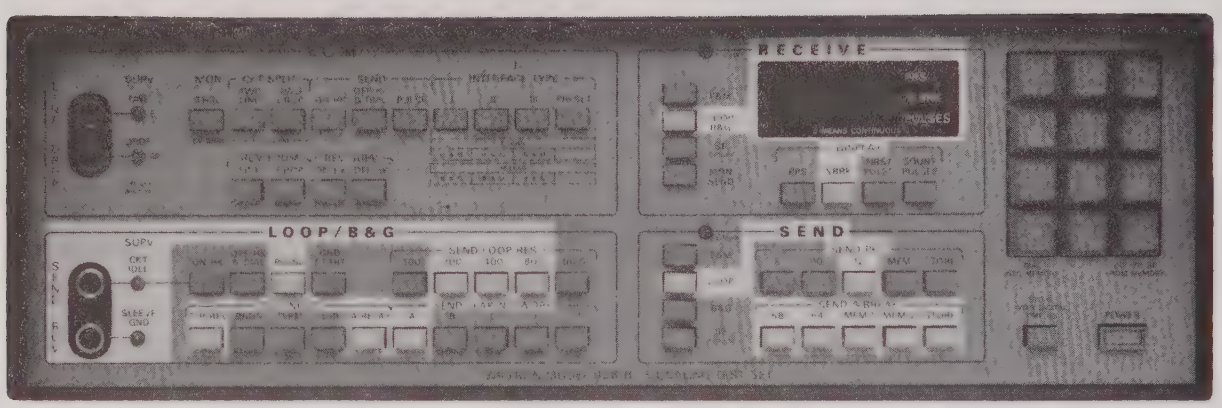

Figure 4-10. Verify A-Relay

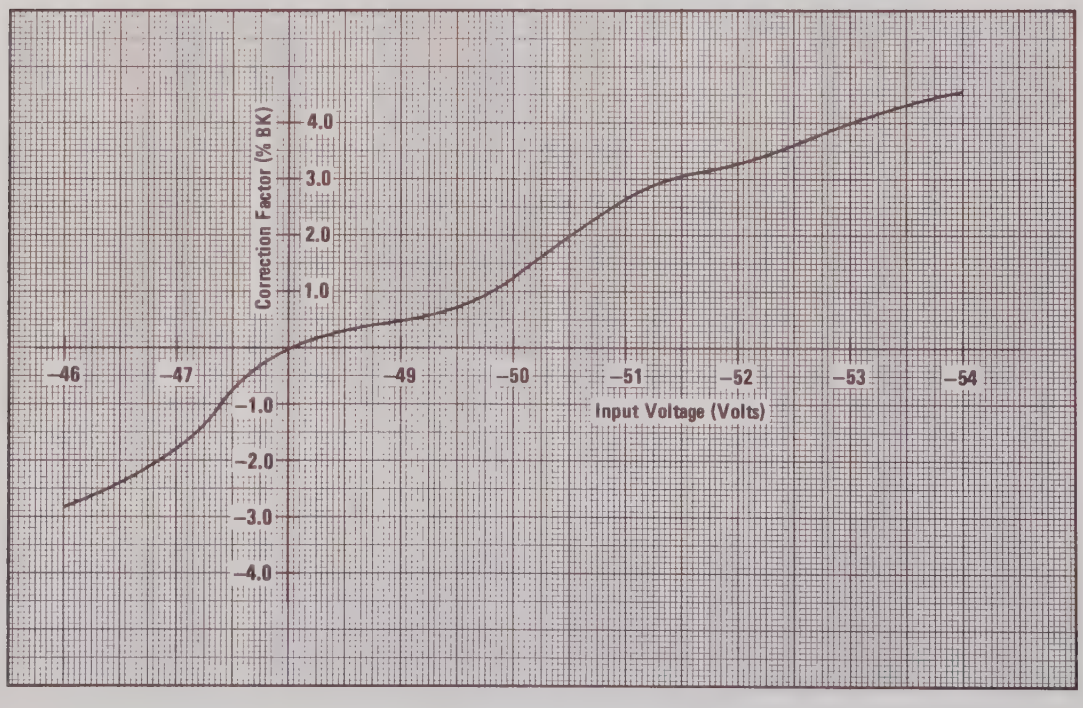

Figure 4-11. A-Relay Voltage Correction Factor (Typical)

For example, if the battery voltage is -51.0 volts, the % BRK correction factor from Figure 4-11 is +2.8%. Therefore, the correct A-Relay calibration is the nominal value, 60.5%, plus the 2.8% correction factor, which is 63.3% BRK.

Table 4-11. Verify TALK/LISTEN (Option 3)

STEP	PROCEDURE
	NOTE 1 Test equipment required is a 2-wire telephone handset connected to Tip and Ring on a 310 plug. NOTE 2 The SF listen circuit is level-coordinated to 0 dBmO from either +7 or -16 TLP.
1	Select the switches shown in Figure 4-12: SEND PPS: 12 SEND % BRK: 64 SEND: LOOP LOOP/B&G: PULSE SEND LOOP RES: 400 and 800 (1200 Total) RCV INPUT: A-RLY
2	Patch a 310 to 310 cord from LOOP/B&G SEND jack to LOOP/B&G RCV jack. The sender output is now connected to the LOOP/B&G SEND jack and sending pulses through the patch cord to the built-in A-Relay.
3	Connect the handset to the 310 jack on the TALK/LISTEN panel. With the LOOP TALK/LISTEN switch out, the handset is not connected to the loop circuit. Check that with the LOOP TALK/LISTEN switch out, no pulses are received by the handset.
4	Select the LOOP TALK/LISTEN switch and check that pulses are being heard from the handset.
5	If Option 5 (SF Adapter) is equipped, select the following switches: SEND PPS: 12 SEND % BRK: 64 SEND: SF SF TLP: LINE and DROP (both) SEND: PULSE
6	Patch a 310 to 310 cord from SF SEND jack to SF RCV jack. The sender output is connected to the SF SEND jack and is sending pulses through the patch cord to the SF RCV jack.

(continued on next page)

Table 4-11. Verify TALK/LISTEN (Option 3) (Continued)

STEP	PROCEDURE
7	Connect the handset to the 310 jack on the TALK/LISTEN panel. With the SF LISTEN switch out, the handset is not connected to the SF circuit. Check that with the SF LISTEN switch out, no pulses are received by the handset.
8	Select the SF LISTEN switch and check that SF pulses are heard from the handset.

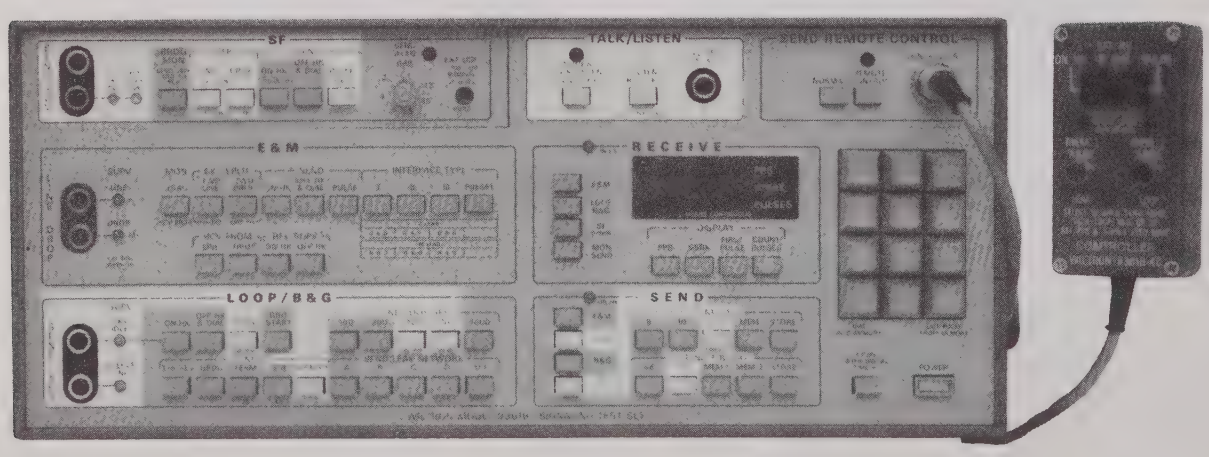

Figure 4-12. Verify TALK/LISTEN

Table 4-12. Verify SEND/REMOTE CONTROL (Option 4)

STEP	PROCEDURE
1	Select the switches shown in Figure 4-13: SEND: LOOP RECEIVE: LOOP/B&G SEND LOOP RES: 400 and 800 SEND LEAK NETWORK: A RCV INPUT: A-RELAY DISPLAY: PPS
2	Patch the LOOP/B&G SEND jack to the RCV jack.
3	Select REMOTE CONTROL button. Set the Controller to ON HK. Check that both ON HK indicators light.
4	Set the Controller to OFF HK & DIAL. Listen for the A-Relay to operate and observe that both ON HK indicators go out.
5	Dial a 9. Listen for the A-Relay operating and observe the PPS reading on the display (20 PPS is the speed being sent, or whatever speed has been stored in SEND PPS MEM.
6	Set the Controller to PULSE. Listen for the A-Relay operating continuously at 20 PPS.
7	Press the LEAK button, then the LOOP button on the Controller. Listen for the duty cycle of the A-Relay changing as the 1200 loop selected is changed to Leak Network A.
8	Enter a telephone number into memory (see Table 4-5). Select OFF HK & DIAL and LOOP on the Controller; set the DISPLAY to COUNT PULSES. Operate the LOOP pushbutton on the Controller again. The telephone number in the memory should now be dialed out automatically.

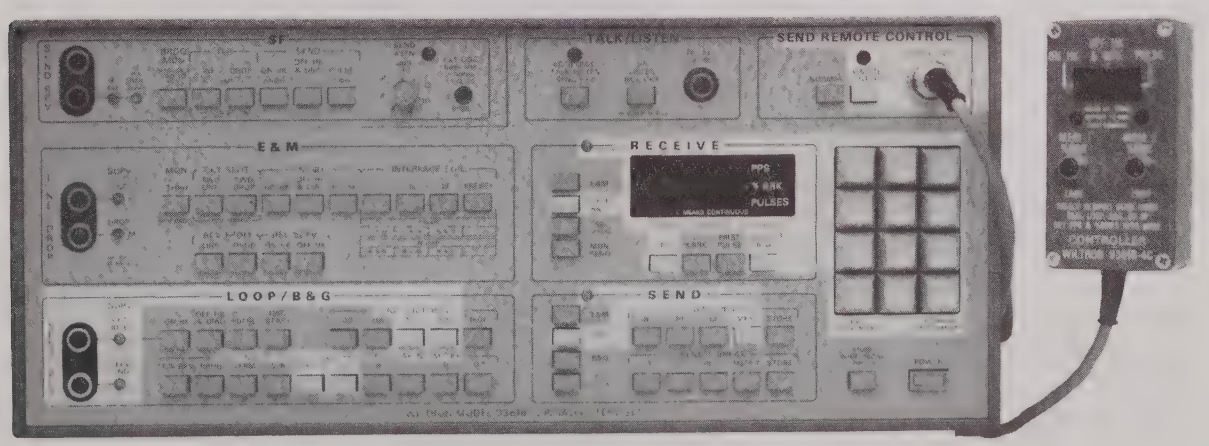

Figure 4-13. Verify SEND/REMOTE CONTROL

Table 4-13. Verify SF Adapter (Option 5)

STEP	PROCEDURE
1	Select the switches shown in Figure 4-14. RECEIVE: SF (Option) SEND: SF (Option) SF SEND: PULSE (-8 dBmO) SEND: 12 PPS SEND % BREAK: 58 DISPLAY: % BRK or PPS
2	Patch a 310 to 310 cord from the SF SEND to the SF RCV jack. Select the SF TLP: DROP switch. You are now sending a continuous 2600 Hz tone (internally generated) at a level of -13 dBm (-20 dBmO at a +7 TLP). The expected receive level is at a -16 TLP. Check that the SF CKT IDLE lamp is lit, indicating that the SF signal is being received. Check that the SF RCV OVERLOAD lamp is lit, indicating the received SF signal is too high for the expected TLP.
3	Select the SF TLP: LINE switch. You are now sending a continuous 2600 Hz tone at a level of -36 dBm. The expected receive level is at a +7 TLP. Check that the SF CKT IDLE and SF RCV OVERLOAD lamps are off, When SF SEND ON HK indicating that either no SF signal or an SF signal below the receiver threshold is being received.
4	Release the SF TLP: LINE and DROP switches. NOTE With both the SF LINE and DROP switches out, the SF send and receive level is at a -16 TLP. This allows the SF unit to be looped-back without the need for an amplifier or attenuator. Similarly, if both SF LINE and DROP switches are operated, the send and receive TLP is +7. Check that only the SF CKT IDLE lamp is lit, indicating that the receive SF level is in the receiver input range and not overloading.
5	Rotate the SF SEND attenuator counterclockwise (CCW). You are now attenuating the SF send level. Check that with 10 dB ±1.5 dB, the SF CKT IDLE lamp goes off, indicating the received level is below the receiver input threshold. Check that the red indicating light next to SF SEND ATTEN is lit, indicating the switch is in the off-normal position.

Table 4-13. Verify SF Adapter (Option 5) (Continued)

STEP	PROCEDURE
6	Set the SF SEND ATTEN to the 0 dB position (red indicator light off). Select the SF SEND PULSE switch. Pulses at 12 PPS and 58% Break are being sent at an amplitude of -24 dBm (-8 dBmO at -16 TLP). Check that the DISPLAY indicates the measurement of 58.0 ± 0.2% BRK (or 60.5 or 55, as applicable).

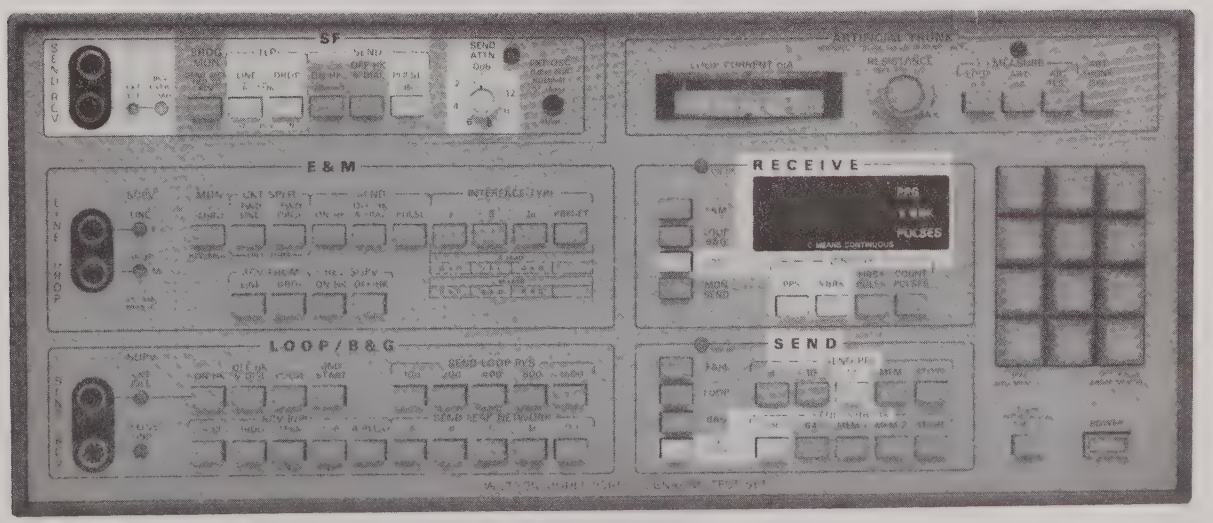

Figure 4-14. Verify SF Adapter

Table 4-14. Verify ARTIFICIAL TRUNK (Option 6)

STEP	PROCEDURE
1	Select the switches shown in Figure 4-15. SEND PPS: 12 SEND % BREAK: 58 (60.5 as applicable) SEND: LOOP LOOP/B&G SEND: PULSE RCV INPUT: TERM T/R REV: out SEND LOOP RES: none SEND LEAK NETWORK: none RECEIVE: LOOP/B&G DISPLAY: % BRK ARTIFICIAL TRUNK: ART TRUNK OFF
2	Patch a 310 to 310 cord from LOOP/B&G SEND jack to LOOP/B&G RCV jack. The sender output is now connected to the receiver input and the Artificial Trunk unit is disconnected. Check that the red indicator light on the artificial trunk unit is off, and that the display indicates the measurement of 58.0 ±0.2% BRK.
3	Remove the 310 patch cord from the LOOP/B&G RCV jack.
4	Select the ARTIFICIAL TRUNK MEASURE: LOOP mA switch. In this mode, the Artificial Trunk unit is ready to measure the dc current of the loop connected to the LOOP/B&G SEND jack. Observe the red indicator light to be on, indicating that the Artificial Trunk unit is on.
5	Select the LOOP/B&G: OFF HK & DIAL switch. Apply a short between the Tip and Ring of the cord connected to the LOOP/B&G SEND jack. You now have a complete dry loop. Normally, this cord would be connected to a trunk terminated into a relay feeding battery and ground to the loop. Observe that the ARTIFICIAL TRUNK: LOOP CURRENT mA meter indicates 0mA.
6	Select the SEND: B&G switch. You now have a wet loop. Battery current is flowing through the short on the Tip and Ring of the cord connected to the LOOP/B&G SEND jack. Observe the ARTIFICIAL TRUNK: LOOP CURRENT mA meter indicating >150mA. Note that the meter is protected from over-current.

Table 4-14. Verify ARTIFICIAL TRUNK (Option 6) (Continued)

STEP	PROCEDURE
7	On the LOOP/B&G panel, select SEND LOOP RES: 1600. Now you have 1600Ω in the loop. Check that the LOOP CURRENT mA meter indicates 30 ±2mA. NOTE Because of current-limiting protection from battery and ground in the 9361B mainframe, the expected current may be less when selecting lower loop resistances.
8	Select the ARTIFICIAL TRUNK: ART mA switch. The internal LOOP/B&G sender is now connected, through the Artificial Trunk Resistance, to the internal LOOP/B&G receiver input. On the LOOP/B&G panel, select SEND LOOP RES: 0 (all out). Adjust the ARTIFICIAL TRUNK RESISTANCE for a reading of 60mA. The Artificial Trunk resistance is now set to 800Ω.
9	Select the following switches: LOOP/B&G SEND: PULSE RCV INPUT: A-RLY ARTIFICIAL TRUNK: ART TEST The LOOP/B&G sender is connected to the LOOP/B&G SEND jack and internally to the A-Relay through the Artificial Trunk Resistance. The LOOP/B&G SEND jack would normally be connected to the desired trunk circuit. Check that while holding a short between the Tip and the Ring of the cord connected to the LOOP/B&G SEND jack, the RECEIVE ON HK indicator is OFF.
10	Remove the short between the Tip and the Ring of the LOOP/B&G SEND jack and check that the RECEIVE ON HK indicator is flashing and the A-Relay is heard to be operating.
11	Restore the LOOP/B&G circuit to normal by selecting the ARTIFICIAL TRUNK: ART TRUNK OFF switch.

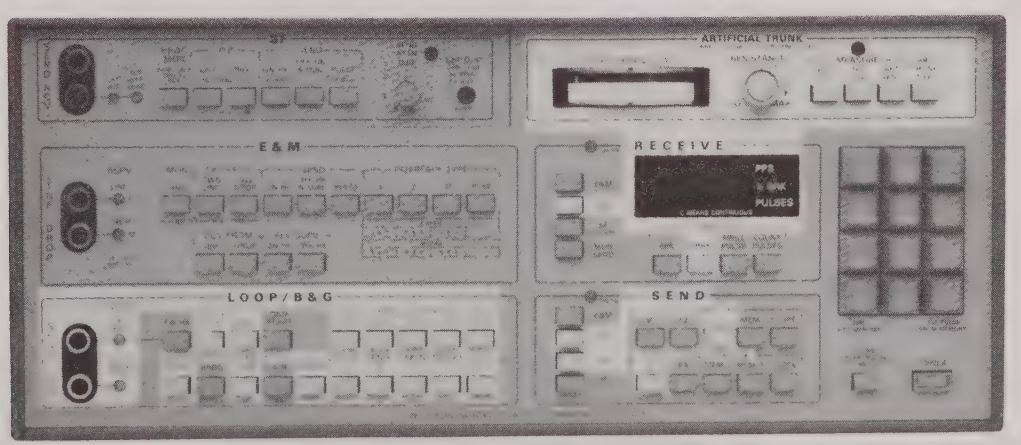

Figure 4-15. Verify ARTIFICIAL TRUNK

Table 4-15. Verify E&M Interface Preset Switches (Option 7)

STEP	PROCEDURE
	CAUTION If the AC Converter is being used, use the ground for the E&M configuration on the rear panel.
1	Select the switches shown in Figure 4-16a: SEND PPS: 12 SEND % BRK: 64 SEND: E&M E&M CKT SPLIT: TWD LINE RCV FROM: DROP SEND: PULSE INTERFACE TYPE: PRESET RECEIVE: E&M DISPLAY: % BRK
2	Patch a 310 to 310 cord from E&M LINE jack to E&M DROP jack. The sender output is now connected to the E&M LINE jack and is sending pulses through the patch cord to the E&M DROP jack. The kind of interface on the M lead is determined by the M lead switch setting, i.e., B/G, B/O or G/O.
3	On the rear panel, set the M lead switch to each of its positions and observe the Display reading to indicate 64.0 ±0.2% BRK. The M lead switch changes the interface to both the M lead sender and M lead receiver.
4	Remove the 310 cord plugged into the E&M DROP jack and apply a short from Tip to Ring on this cord.
5	Select E&M RCV FROM: LINE. With the Tip shorted to the Ring, you are now sending on the M lead and receiving on the E lead of the LINE jack.
6	Verify the display reading with the following switch settings on the rear panel:

M-Lead	E-Lead	Display	Comment
B&G	G&O	36.0	Sender and Receiver reversed
B&O	G&O	Blank	N/A
G&O	G&O	64.0	Sender and Receiver matched
B&G	G&B	36.0	Sender and Receiver reversed
B&O	G&B	Blank	N/A
B&O	G&B	64.0	Sender and Receiver matched

Table 4-16. Verify Remote Display Output (Option 8)

STEP	PROCEDURE
1	Perform any of the previous tests until a test result is displayed on the Model 9361B Test Set.
2	Go to the Remote Display and verify that the same result is displayed at the remote location.
3	Repeat for all displays.

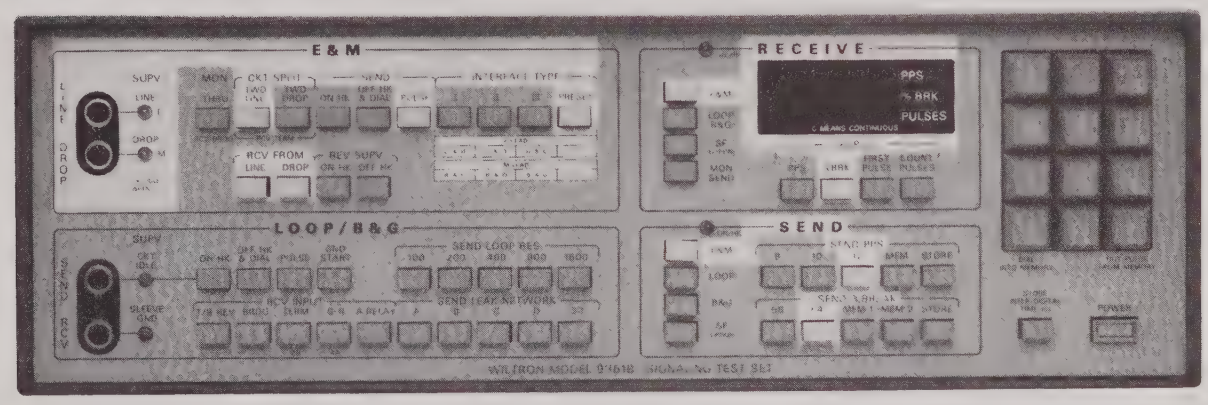

Figure 4-16a. Verify E&M Interface Preset Switches

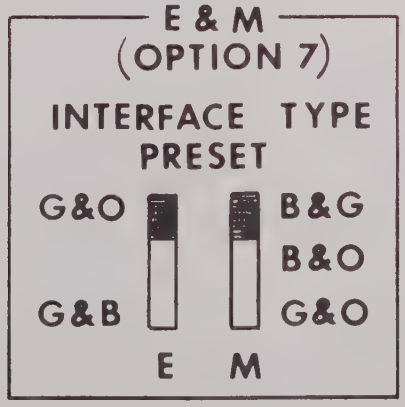

Figure 4-16b. Rear Panel Interface Selection Switches

Table 4-17. Verify MF/DTMF Communications Panel Operation for LOOP/B&G

STEP	PROCEDURE
	NOTE Test equipment required is one 4-wire telephone headset connected to a dual tip/sleeve plug and one 2-wire telephone set connected to a tip/ring plug.
1	Select the switches shown in Figure 4-17: SEND: PPS: 12 SEND % BRK: 64 SEND: LOOP SEND MODE: DIAL PULSE APPLICATION: OFF LOOP/B&G: OFF HK & DIAL SEND LOOP RES: 0 SEND LEAK NETWORK: none selected
2	Connect a 2-wire telephone set to the LOOP/B&G SEND jack and connect the 4-wire headset to the MF/DTMF COMM PANEL HEADSET jack.
3	On the Model 9361B keypad, press * and a series of random numbers.
4	While listening on the 2-wire telephone set, press the Model 9361B keypad # key and check for pulses.
	NOTE Because of sidetone, voice frequency signals output from the COMM PANEL (that is, MF/DTMF tones, voice, test tones from a TMS) will be heard in the 4-wire headset receiver.
5	Select SEND MODE DTMF and APPLICATION LOOP SEND on the COMM PANEL.
6	Press # and check that DTMF tones are heard on the 2-wire telephone and the 4-wire headset.

Table 4-17. Verify MF/DTMF Communications Panel Operation for LOOP/B&G (Continued)

STEP	PROCEDURE
7	Select SEND MODE MF and repeat step 6. Check that MF tones are heard.
8	While listening on the 2-wire telephone set, speak into the transmitter of the 4-wire headset, then into the transmitter of the 2-wire telephone. Check that voice signals are heard.

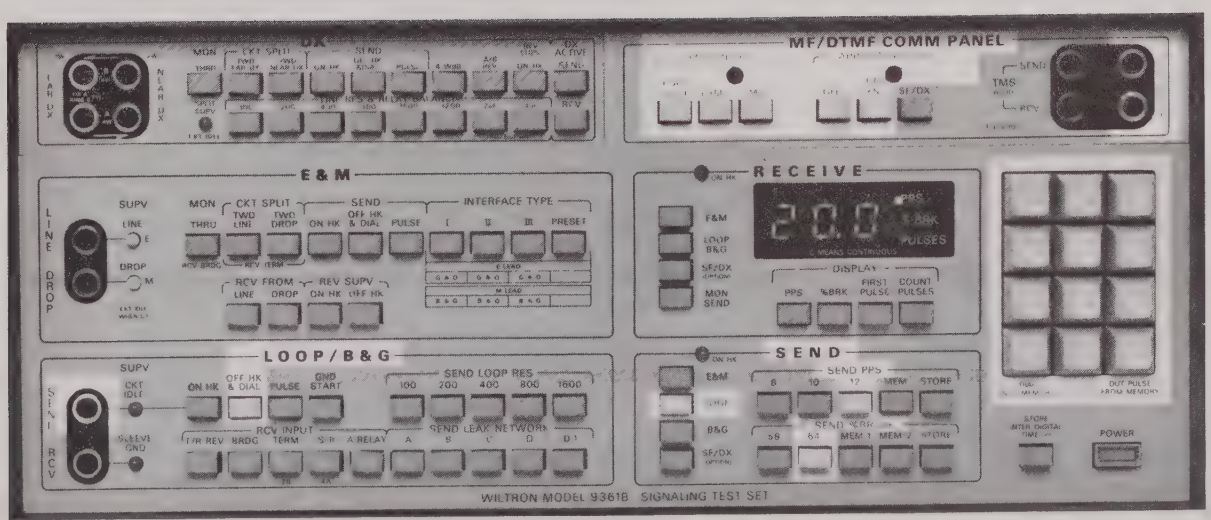

Figure 4-17. Verify MF/DTMF Communications Panel Operation for LOOP/B&G

Table 4-18. Verify MF/DTMF Communications Panel Operation for SF Adapter

STEP	PROCEDURE
	NOTE Test equipment required is one 4-wire telephone headset connected to a dual tip/sleeve plug, one 2-wire telephone set connected to a tip/ring plug, and a double-ended 310 patch cord.
1	Select the switches shown in Figure 4-18: SEND PPS: 12 SEND % BRK: 64 SEND: SF/DX SEND MODE: DIAL PULSE APPLICATION: OFF
2	Connect the 2-wire telephone set to the SF SEND jack and connect the 4-wire headset to the MF/DTMF COMM PANEL HEADSET jacks.
3	Select the SF TLP LINE and SEND OFF HK & DIAL pushbuttons.
	NOTE If the Model 9361B is also equipped with Option 14 (DX Adapter), the DX ACTIVE SEND and RCV switches must be out to enable the SF Adapter.
4	On the Model 9361B keypad, press * and a series of random numbers.
5	While listening on the 2-wire telephone set, press the Model 9361B keypad # key. Check that SF dial pulse tones are heard.
6	Select the SEND MODE MF and APPLICATION SF/DX pushbuttons.
	NOTE Because of sidetone, voice frequency signals output from the COMM PANEL (that is, MF/DTMF tones, voice, test tones from a TMS) will be heard in the 4-wire headset receiver.
7	Repeat step 5 and verify that MF tones are heard.

Table 4-18. Verify MF/DTMF Communications Panel Operation for SF Adapter (Continued)

STEP	PROCEDURE
8	While listening on the 2-wire telephone set, speak into the transmitter of the headset. Check that voice signals are heard on the 2-wire telephone set.
9	Patch the SF RCV jack to the SF SEND jack.
10	Select the SF SEND ON HK pushbutton.
11	Verify that the SF on-hook tone is heard in the headset.

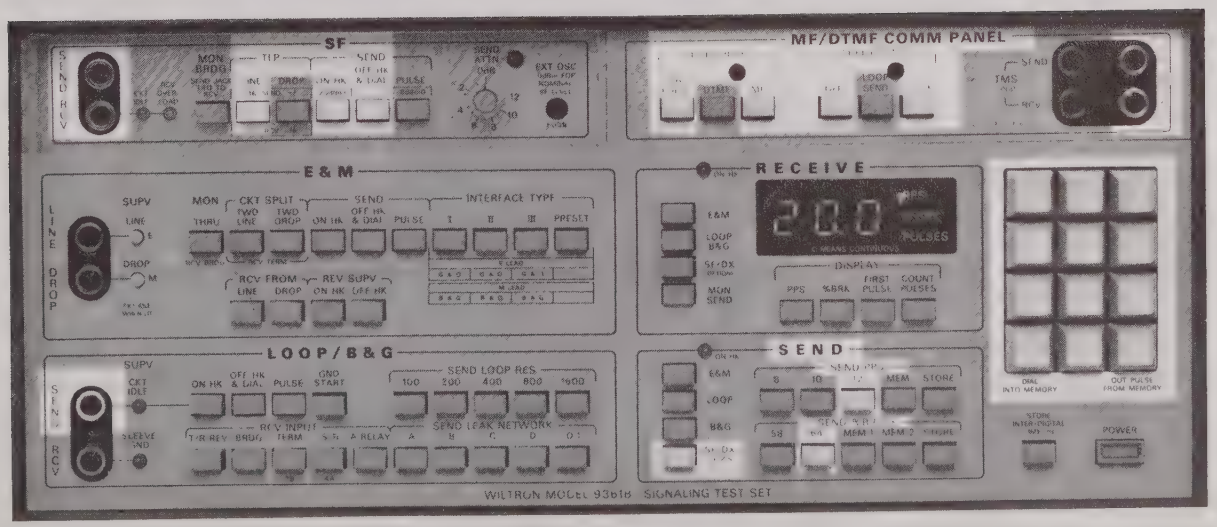

Figure 4-18. Verify MF/DTMF Communications Panel Operation for SF Adapter

Table 4-19. Verify MF/DTMF Communications Panel Operation for DX Adapter (2-Wire)

STEP	PROCEDURE
	NOTE Test equipment required is one 4-wire telephone headset connected to a dual tip/sleeve plug, one 2-wire telephone set connected to a tip/ring plug, and a double-ended 310 patch cord.
1	Select the switches shown in Figure 4-19: SEND Panel SEND PPS: 12 SEND % BRK: 64 SEND: SF/DX MF/DTMF COMM PANEL SEND MODE: DIAL PULSE APPLICATION: OFF DX Panel CKT SPLIT: TWD FAR DX SEND: OFF HK & DIAL 4 WIRE: out DX ACTIVE: SEND RCV LINE RES & RELAY BALANCE: 0 ohms, 6μF (2 & 4 pressed)
2	Connect the 2-wire telephone set to the 2W TO FAR DX SET jack, and connect the 4-wire headset to the COMM PANEL HEADSET jacks.
3	On the Model 9361B keypad, press * and a series of random numbers.
4	Press the Model 9361B # key. Verify that no tones are heard on the 2-wire telephone set.
5	Select the MF/DTMF COMM PANEL DTMF and SF/DX pushbuttons.

Table 4-19. Verify MF/DTMF Communications Panel Operation for DX Adapter (2-Wire) (Continued)

STEP	PROCEDURE
6	While listening on the 2-wire telephone set, press the Model 9361B keypad # key. Check that DTMF tones are heard on the 2-wire telephone set. NOTE Because of sidetone, voice frequency signals sent from the COMM PANEL (that is, MF/DTMF tones, voice, test tones from a TMS) will be heard in the 4-wire headset receiver.
7	While listening on the 2-wire telephone set, speak into the transmitter of the 4-wire headset, then into the transmitter of the 2-wire telephone. Check that voice signals are heard.

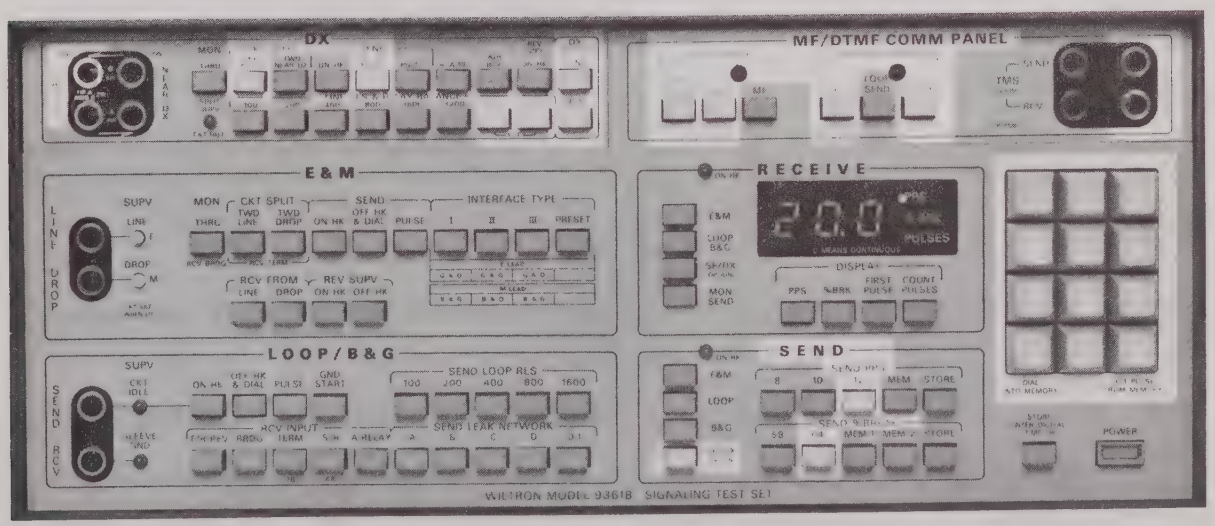

Figure 4-19. Verify MF/DTMF Communications Panel Operation for DX Adapter (2-Wire)

Table 4-20. Verify MF/DTMF Communications Panel Operation for DX Adapter (4-Wire)

STEP	PROCEDURE
	NOTE Test equipment required is one 4-wire telephone headset connected to a dual tip/sleeve plug, one 2-wire telephone set connected to a tip/ring plug, and a double-ended 310 patch cord.
1	Select the switches shown in Figure 4-20: SEND PPS: 12 SEND % BRK: 64 SEND: SF/DX SEND MODE: MF or DTMF APPLICATION: SF/DX DX CKT SPLIT: FAR DX SEND: OFF HK & DIAL 4 WIRE: in DX ACTIVE: SEND RCV LINE RES & RELAY BALANCE: 0 ohms, 6μF
2	Connect the 2-wire telephone set to the 4W transmit jack (top left), and connect the 4-wire headset to the MF/DTMF COMM PANEL HEADSET jacks.
3	On the Model 9361B keypad, press * and a series of random numbers.
4	Press the Model 9361B # key. Verify that dial pulses are heard on the 2-wire telephone set.
5	Select the MF/DTMF COMM PANEL DTMF and SF/DX pushbuttons.
6	While listening on the 2-wire telephone set, press the Model 9361B keypad # key. Check that DTMF tones are heard on the 2-wire telephone set.
	NOTE Because of sidetone, voice frequency signals output from the COMM PANEL (that is, MF/DTMF tones, voice, test tones from a TMS) will be heard in the 4-wire headset receiver.

Table 4-20. Verify MF/DTMF Communications Panel Operation for DX Adapter 4-Wire (Continued)

STEP	PROCEDURE
7	While listening on the 2-wire telephone set, speak into the transmitter of the headset. Check that voice signals are heard on the 2-wire telephone set.
8	If the Model 9361B is equipped with the SF Adapter, patch the SF SEND jack to the DX adapter FAR DX "A" pair (bottom left DX jack). Select SF SEND ON HK and TLP DROP.
9	Verify that the SF On-Hook tone is heard on the 4-wire headset.

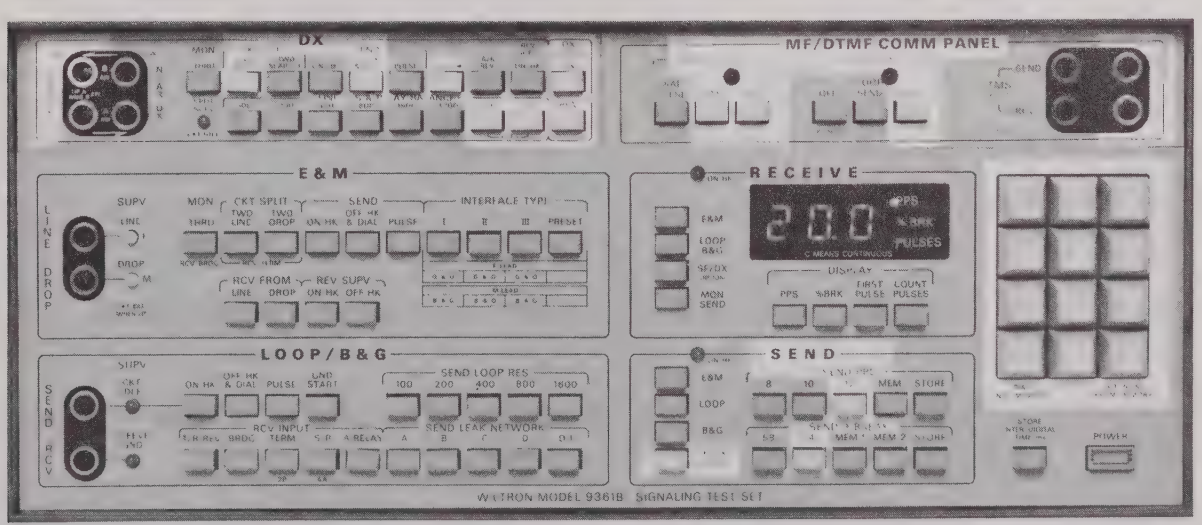

Figure 4-20. Verify MF/DTMF Communications Panel Operation for DX Adapter (4-Wire)

Table 4-21. Verify DX Bridging Measurement

STEP	PROCEDURE
1	Select the switches shown in Figure 4-21: MON THRU: in SEND: PULSE 4 WIRE: out A/B REV: out DX ACTIVE: SEND and RCV SEND PPS: 10 SEND % BREAK: 64 SEND: SF/DX RECEIVE: SF/DX SEND MODE: DIAL PULSE (if COMM PANEL is equipped)
2	Check that the SEND and RECEIVE ON HK indicators are flashing, which indicates pulses are being sent through the DX Adapter to the Receive Panel.
3	Select RECEIVE DISPLAY PPS and check that the received pulses = 10 ±0.1 count.
4	Select RECEIVE DISPLAY % BREAK and check that the received % break = 64.0 ±1%.
5	Select A/B REV and check that the % break is the complement of the value noted in step 4 (for example, if % break in step 4 = 64%, the value noted after selecting A/B REV should be 100% - 64%, or 36% ±1%).

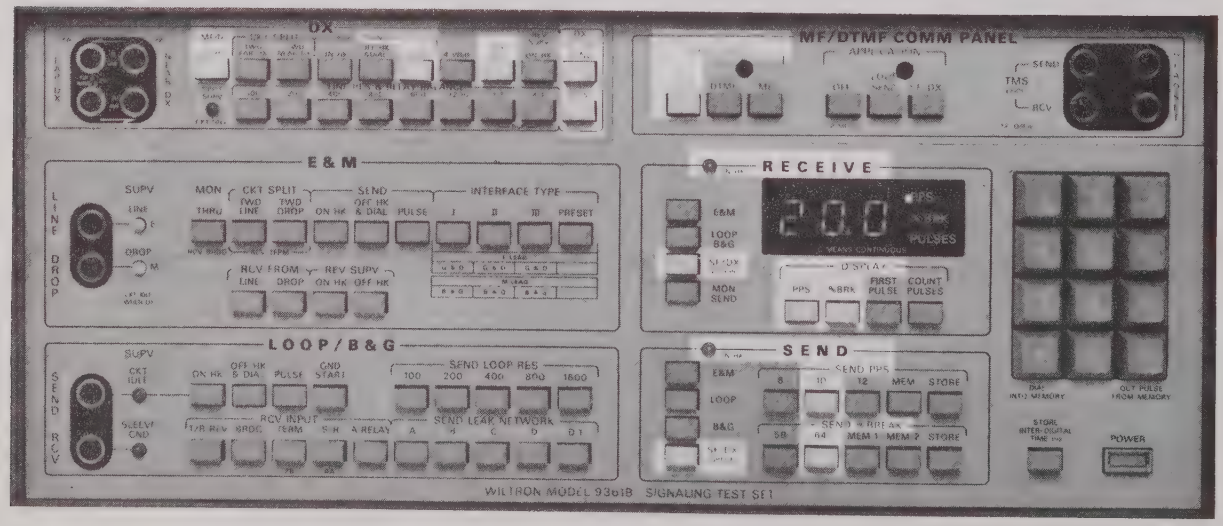

Figure 4-21. Verify DX Bridging Measurement

Table 4-22. Verify DX Pulse Sending

STEP	PROCEDURE
	NOTE Test equipment required is one double-ended 310 patch cord.
1	Patch the E&M DROP jack to the DX TO FAR DX SET - top left jack.
2	Select the switches shown in Figure 4-22: E&M CKT SPLIT: TWD DROP INTERFACE TYPE: I RCV FROM: DROP SEND: ON HK DX CKT SPLIT: TWD FAR DX SEND: PULSE DX ACTIVE: SEND SEND PPS: 10 SEND % BREAK 64 SEND: SF/DX RECEIVE: E&M SEND MODE: DIAL PULSE (if COMM PANEL is (equipped)
3	Check that the SEND and RECEIVE ON HK indicators and the E&M DROP M indicator are flashing, which indicates pulses are being sent from the DX Adapter through the E&M Panel to the Receive Panel.
4	Select RECEIVE DISPLAY PPS and check that the received pulses = 10 ±0.1 count.
5	Select RECEIVE DISPLAY % BREAK and check that the received % break = 64.0 ±0.5% BREAK.

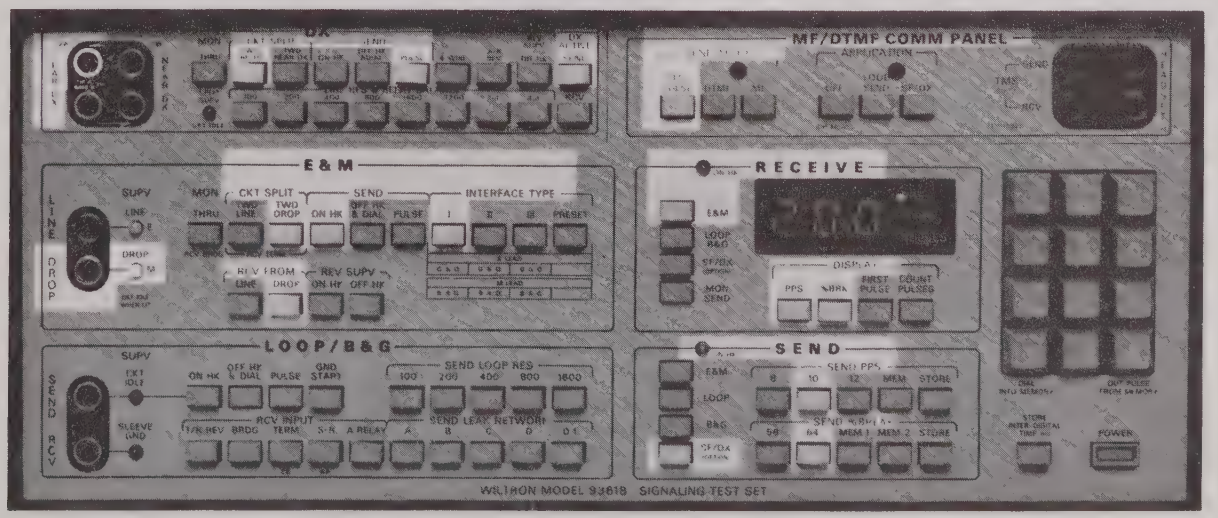

Figure 4-22. Verify DX Pulse Sending

Table 4-23. Verify DX Receiver Operation

STEP	PROCEDURE
	NOTE Test equipment required is one double-ended 310 patch cord.
1	Patch the E&M LINE jack to the DX TO NEAR DX SET-top right jack.
2	Select the switches shown in Figure 4-23: E&M CKT SPLIT: TWD LINE INTERFACE TYPE: I SEND: PULSE DX CKT SPLIT: TWD NEAR DX SEND: ON HK DX ACTIVE: RCV IN, SEND OUT LINE RES & RELAY BALANCE: 800 A/B REV: OUT SEND SEND PPS: 10 SEND % BREAK: 64 SEND: E&M RECEIVE: SF/DX COMM PANEL (if equipped) SEND MODE: DIAL PULSE
3	Check that the SEND and RECEIVE ON HK indicators are flashing, which indicates that pulses are being sent from the E&M Panel through the DX Adapter to the Receive Panel.

Table 4-23. Verify DX Receiver Operation (Continued)

STEP	PROCEDURE
4	The DX and pulsing relays should now be heard.
5	Select RECEIVE DISPLAY PPS and check that the received pulses = 10 ±0.1 pps.
6	Select RECEIVE DISPLAY % BREAK and check that the received % break = 37.5%.

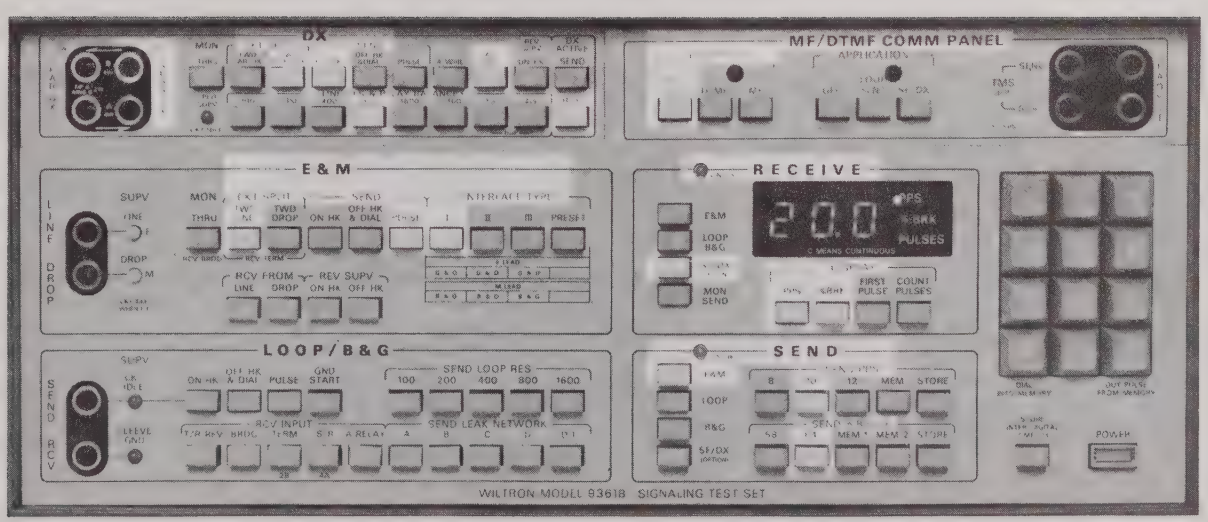

Figure 4-23. Verify DX Receiver Operation

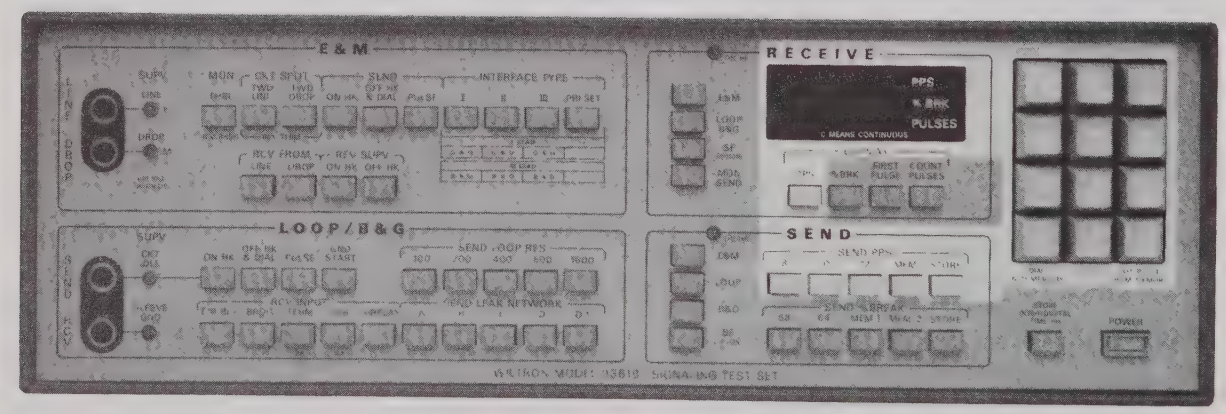

Figure 5-1. Sending A Selectable PPS Speed

SECTION V

TEST SET OPERATING PROCEDURES

SECTION	CONTENTS	PAGE
5.01	GENERAL	5-1
5.02	MEASURING DISTORTION ON ANY PULSE	5-8
5.03	USING THE TALK/LISTEN	5-9
5.04	USING THE MF/DTMF COMM PANEL	5-13

5.01 GENERAL

Tables 5-1 through 5-3 give procedures for sending a selectable PPS speed, sending at a selectable % Break value, and using the keypad to send digits. Tables 5-4 and 5-5 describe the functions which use the Test Set memory, selecting the inter-digital timing and storing a number for repeat dialing. Measuring First Pulse Distortion is included in Table 5-6, and a method to determine the distortion on any pulse is included in paragraph 5.02.

E&M Interface Types I, II and III can be selected using internal switches on the E&M board, as shown in Tables 5-7 and 5-8. Tables 5-9 through 5-12 give procedures for using the Talk/Listen option. Tables 5-13 through 5-16 describe use of the MF/DTMF Communications Panel.

Table 5-1. Sending a Selectable PPS Speed

STEP	PROCEDURE
1	Select the RECEIVE PPS switch as shown in Figure 5-1. Press the 8, 10, or 12 SEND PPS pushbutton as required to select the desired send speed. NOTE Initially, the SEND PPS MEM pushbutton is set for 20 PPS. To select a different send speed (between 0.1 and 29.9 PPS), proceed as follows.
2	With the DISPLAY PPS pushbutton selected, press and hold down the SEND PPS STORE pushbutton.
3	Note the reading on the digital display. This is the PPS speed that is programmed to be sent from memory.
4	To change the PPS speed, press and hold down the SEND PPS STORE pushbutton, then use the keypad to select the new speed (e.g., to select a PPS speed of, say, 8.6 PPS, press the 8 and then the 6). Release the STORE pushbutton. NOTE To select a value less than 3.0 PPS, a leading zero is used. (For example, 2.5 PPS is entered as 0, 2, 5.)
5	The new PPS speed is sent upon releasing the STORE pushbutton.

Table 5-1. Sending a Selectable PPS Speed (Continued)

STEP	PROCEDURE
	NOTE The new selected PPS speed is stored in the memory until it is changed as described above, or until the power is removed from the Signaling Test Set. When power is re-applied, the initial value of 20 PPS is restored to the MEM pushbutton. CAUTION The Model 9361B Sender has a wider speed range than the Receiver. If the sender is set below 5.0 PPS, it will not be detected by the receiver. However, the SEND ON HOOK lamp will flash at the sending rate, indicating that the sender is operating.

Table 5-2. Sending a Selectable % Break Value

STEP	PROCEDURE
1	Select DISPLAY % BRK switch as shown in Figure 5-2. Press one of the % BREAK pushbuttons to select the desired percent break. NOTE Initially, the SEND % BREAK MEM 1 and MEM 2 pushbuttons are set up to send at 49 and 73%, respectively (Option 21: 55 and 70%; Option 22: 58 and 66%; Option 23: 58 and 64%). To select a different % Break (between 0.1 and 99.9% BRK) on either pushbutton, proceed as follows:
2	To change a % BRK value in memory, press either the SEND % BREAK MEM 1 or MEM 2 pushbutton, whichever memory reading is to be changed.
3	Press and hold down the SEND % BREAK STORE pushbutton, and note the display reading. This is the present % Break value. Then use the keypad to select the new % BRK value. For % BRK values under 10%, select a zero ahead of the digits (e.g., for a % BRK of 7.5, enter 075 on the keypad). Release the STORE pushbutton. NOTE The new selected % BRK value is stored in the memory until it is changed as described above, or until the power is removed from the Signaling Test Set. When the power is reapplied, the initial % BRK value is restored.

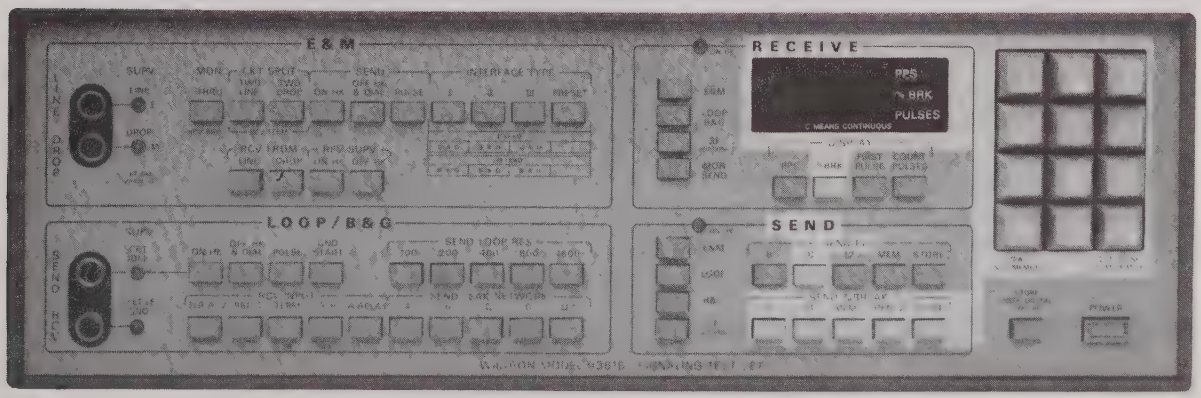

Figure 5-2. Sending a Selectable % Break Value

Table 5-3. Using the Keypad To Send Digits

STEP	PROCEDURE
1	Referring to Figure 5-3, press the OF HK & DIAL pushbutton of the selected SEND mode (either E&M, LOOP/B&G, or SF as desired) to enable the keypad. Select the SEND E&M, LOOP/B&G, or SF pushbutton as appropriate for the signaling mode being used.
2	Select the desired SEND PPS and SEND % BREAK pushbuttons.
3	Use the keypad to send the desired digits. The digits can be entered as fast as desired, but will be outpulsed at the rate selected by the SEND PPS and % BREAK pushbuttons. The SEND indicator flashes as each pulse is sent. NOTE A preset inter-digital time is inserted between digits. This is set at 650 milliseconds, but can be changed over a range of 1 to 999 milliseconds using the keypad. See Table 3-9.

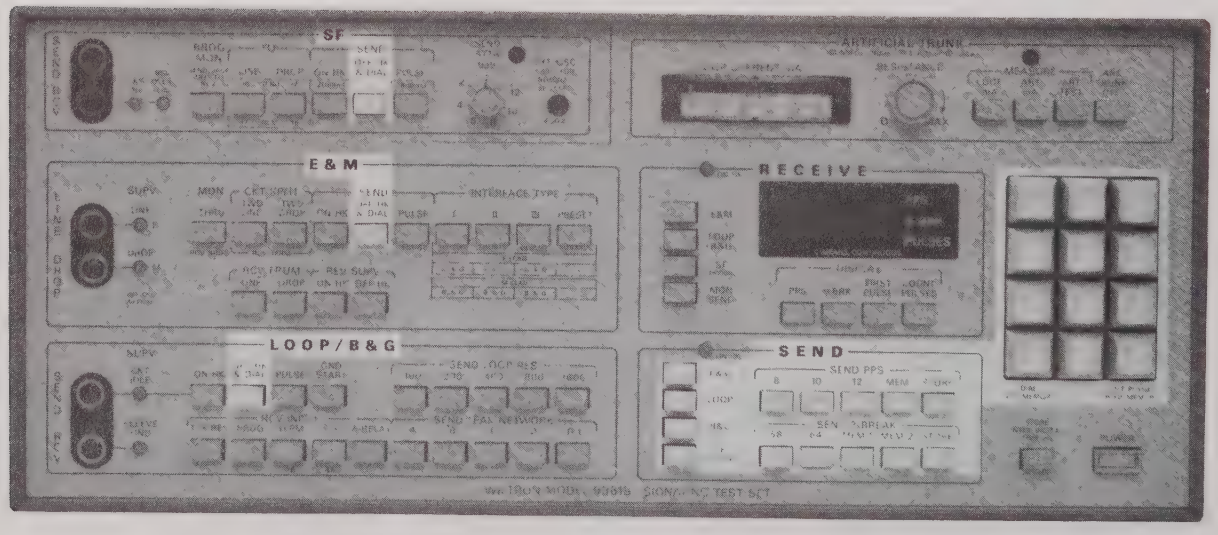

Figure 5-3. Using the Keypad To Send Digits

Table 5-4. Selecting Inter-Digital Time Using the Keypad

STEP	PROCEDURE
	NOTE The sender preset inter-digital time is 650 milliseconds, unless changed as follows:
1	Press the STORE INTER-DIGITAL TIME pushbutton. The display shows the present sender inter-digital time in milliseconds.
2	To change the value, press and hold the STORE INTER-DIGITAL TIME pushbutton while using the keypad to select the desired value (between 001 and 999). Release the pushbutton.
	NOTE The new selected value is stored in memory until it is changed as described above, or until the power is removed from the Signaling Test Set. When power is reapplied, the initial value of 650 milliseconds is restored to the pushbutton.
	CAUTION Only the sender inter-digital time can be changed. The WILTRON receiver has a fixed inter-digital time of 300 milliseconds. If the received dial pulses have less than 300 milliseconds inter-digital time (a very unusual situation), all of the measured results may be invalid.

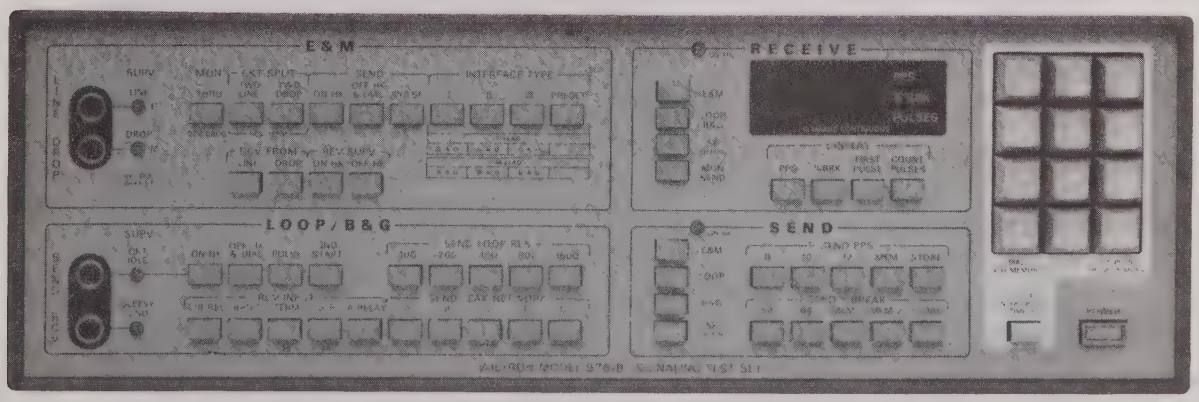

Figure 5-4. Selecting Inter-Digital Time Using the Keypad

Table 5-5. Using the Keypad To Store and Outpulse a Number for Repeat Dialing

STEP	PROCEDURE
	STORE
1	Referring to Figure 5-5, momentarily press the DIAL INTO MEMORY pushbutton on the keypad. Enter the desired telephone number on the keypad (up to 13 digits). The digits can be entered as fast as desired.
	NOTE The number is stored in the memory until it is changed as described above or until the power is removed from the Signaling Test Set.
	OUTPULSE
1	To outpulse the stored number, first select the desired SEND PPS and % BREAK pushbuttons, and INTER-DIGITAL TIME.
2	Press the OFF HK & DIAL pushbutton of the selected SEND mode (E& M, LOOP/B&G or SF, as desired).
3	The stored number is then outpulsed by pressing the OUTPULSE FROM MEMORY pushbutton on the keypad.
	NOTE The outpulse procedure can be repeated as often as desired at any PPS rate and % BK rate. A frequently-dialed number can be dialed into memory as described above. Other numbers can be dialed from the keypad directly (see Table 3-6) without affecting the number already stored in memory. The stored number is lost only when the DIAL INTO MEMORY pushbutton of the keypad is pressed, or if the power is removed from the test set.

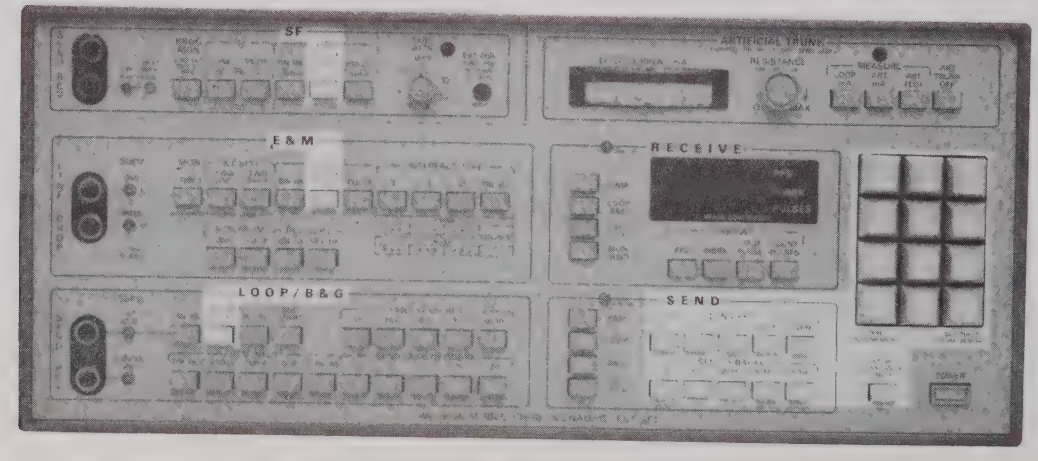

Figure 5-5. Using the Keypad To Store and Outpulse a Number for Repeat Dialing

Table 5-6. Measuring First Pulse Distortion

STEP	PROCEDURE
1	Press the desired RECEIVE pushbutton (E&M, LOOP/B&G, or SF) to suit the type of signaling to be tested.
2	Connect a patch cord from the circuit under test to one of the following: a. For LOOP/B&G or SF, patch to the RCV jack on the LOOP/B&G or SF panel to suit the type of signaling. b. For E&M, patch to the LINE or DROP E&M jack to match whether a line or drop connection is being made. Also select the LINE or DROP pushbutton to match RCV FROM to a line or drop E&M connection.
3	Arrange for someone to dial in on the circuit under test. Have them dial 5.
4	Note that the RECEIVE indicator flashes 5 times. If it does not, check the test set-up.
5	Press the DISPLAY PPS pushbutton. The result displayed is the speed of the dial used.
6	Press the % BRK pushbutton. The result displayed is the % BRK averaged over the 5 pulses measured.
7	Press the FIRST PULSE pushbutton. The result displayed is the % BRK of the first 2 pulses of the 5 pulses received.
8	The First Pulse Distortion is the difference between the results of the % BRK and FIRST PULSE measurements in Steps 6 and 7 above. For example: % BRK reading from above = 61.5 FIRST PULSE reading = 60.2 First Pulse Distortion, therefore, equals 61.5 - 60.2, or -1.3% BRK.

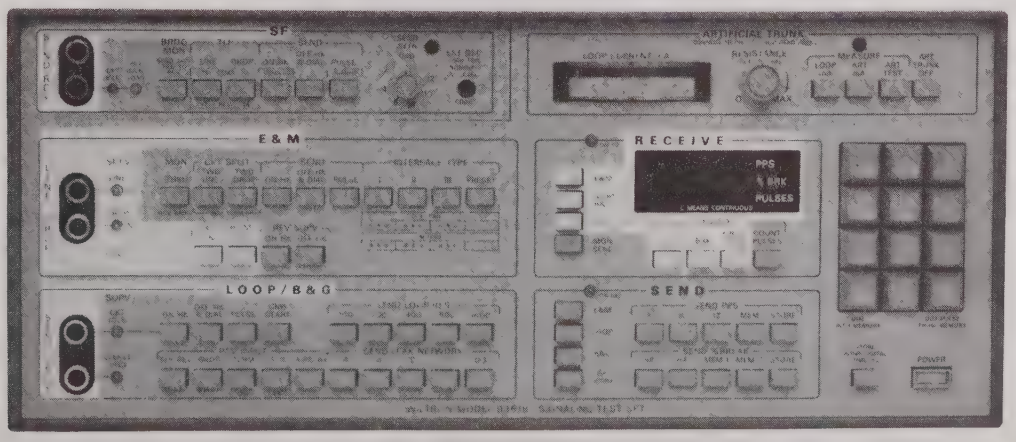

Figure 5-6. Measuring First Pulse Distortion

5.02 MEASURING DISTORTION ON ANY PULSE

If first pulse distortion is within limits but the pulsing is still suspected, other digits can be measured using this procedure, and the bad digit identified. Set up as in Steps 1 and 2 of Table 5-6. In step 3, first have a '3' dialed; press the % BRK button and read the % Break display. If a change is noted, then the third digit is distorted.

Repeat Step 3 for digits 4, 5, 6, 7, 8, 9, and 0. Read the % Break display after each digit is dialed. A significant change in % Break reading will identify a bad digit.

Table 5-7. Selecting Preset E& M Interface Type Using Internal Switches (No Option 7)

STEP	PROCEDURE
1	Turn the system power off. Remove the screws to detach the top cover from the test set.
2	Refer to Figure 5-7 and note the location of the two PRESET switches.
3	Set the E Lead switch to either Ground and Open (G/O) or Ground and Battery (G/B), as desired (Off hook/On hook).
4	Set the M Lead switch to either Battery and Ground (B/G) or Battery and Open (B/O), as desired (Off hook/On hook).
5	Reattach the top cover to the test set. Turn on system power.
6	Press the front panel INTERFACE TYPE: PRESET pushbutton to use the internally-selected interface type.

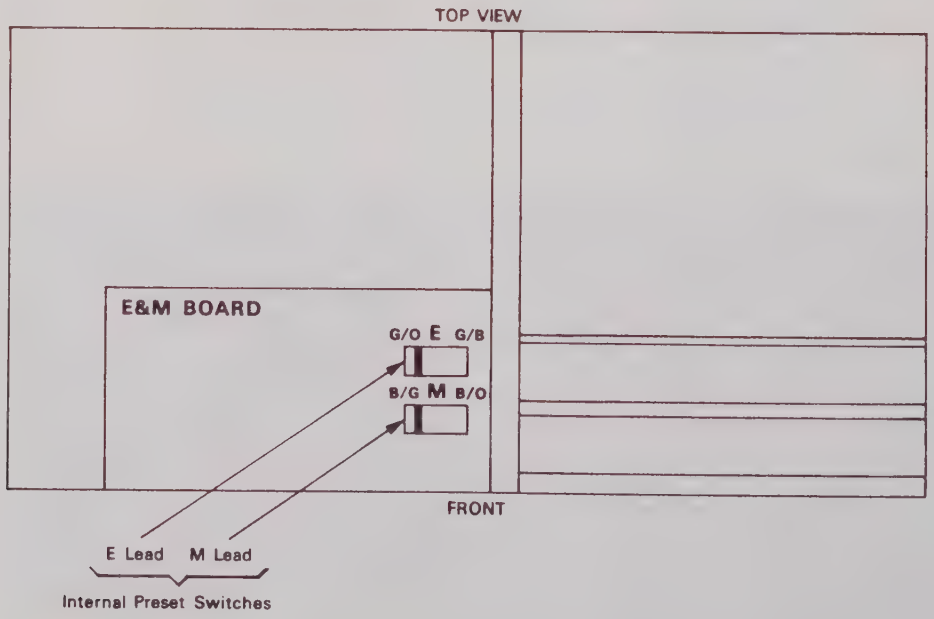

Figure 5-7. Location of Internal Switches for Selection of E& M Interface Type (Option 7 Not Fitted)

Table 5-8. Selecting Preset E&M Interface Type Using Rear Panel Switches (Option 7)

STEP	PROCEDURE
1	Referring to Figure 5-8, note the location of the two E&M INTERFACE TYPE PRESET switches, on the rear panel.
2	Set the E Lead switch to either Ground and Open (G/O) or Ground and Battery (G/B), as desired (Off hook/On hook).
3	Set the M Lead switch to either Battery and Ground (B/G), Battery and Open (B/O), or Ground and Open (G/O) as desired (Off hook/On hook).
4	Press the front panel INTERFACE TYPE PRESET pushbutton to use the rear panel-selected interface type.

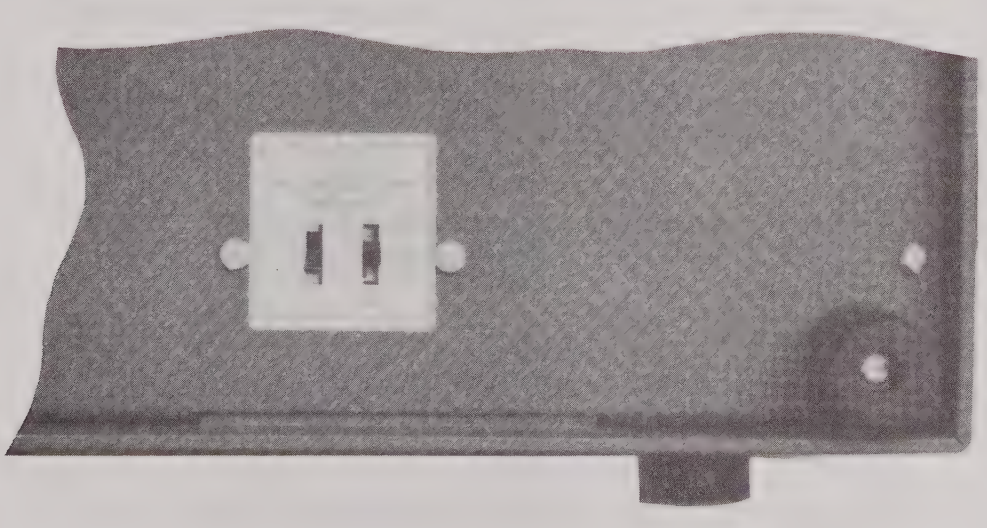

Figure 5-8. Location of Switches for Selection of E&M Interface Preset When Equipped With Option 7

5.03 USING THE TALK/LISTEN

The Talk/Listen option is used for:

- Talking and listening on two-wire Loop or B&G circuits.
- Listening only on SF circuits.
- Measuring transmission and noise by plugging a TMS into the Tel Set jack. Dialing to a milliwatt test number provides loss measurements. Dialing to a quiet termination gives noise measurements.

The Talk/Listen option requires a telephone set with a 310 type plug, wired Tip and Ring.

NOTE

Option 13 enhances the capabilities of the Talk/Listen option (refer to paragraph 5.04). If a talk/dial capability is required, the Model 9361B will normally be ordered with either Option 3 or Option 13. If the 9361B is equipped with both Option 4 and Option 13, the Option 4 panel will be supplied with the remote control function only.

Table 5-9. Using Talk/Listen for Loop/B&G

STEP	PROCEDURE
1	Referring to Figures 4-12 and 5-9, patch the circuit on test to the LOOP/B&G SEND jack and set the controls as follows: LOOP/B&G: OFF HK & DIAL SEND: LOOP or B&G as required SEND PPS: 10 SEND % BRK: 58 (or 60.5) SEND LOOP RES: 0 SEND LEAK NETWORK: 0
2	Dial the desired number.
3	Patch the telephone set into the Tel Set jack on the TALK/LISTEN panel.
4	Operate the LOOP/B&G TALK/LISTEN SEND CKT pushbutton. NOTE The circuit on test is now being completed through the telephone set and will operate as a normal telephone.

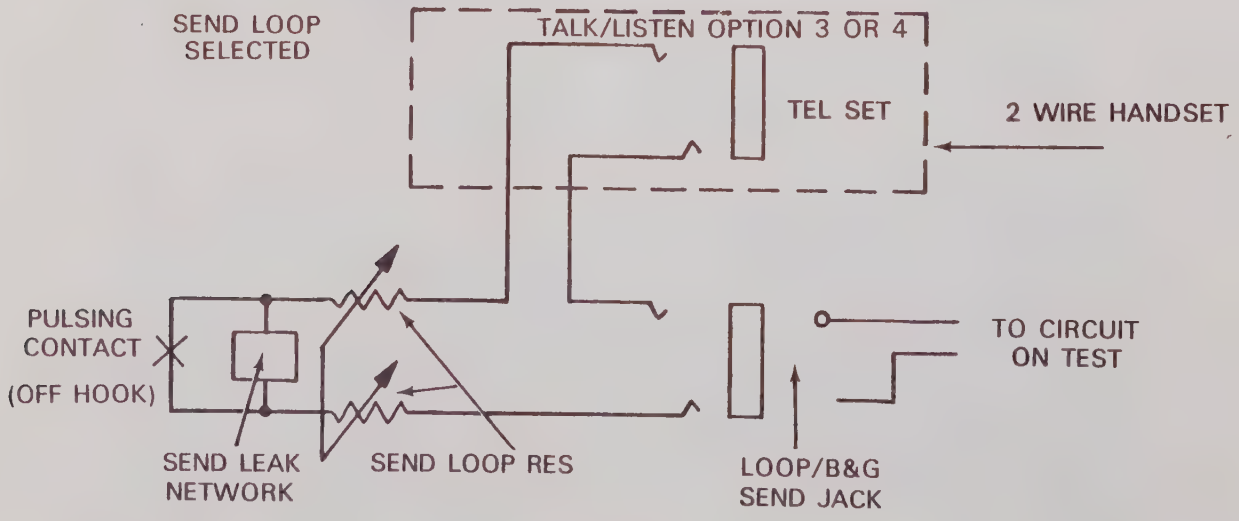

Figure 5-9. Test Setup for Loop/B&G With Talk/Listen

Table 5-10. Using Talk/Listen for Listen Only on SF Circuits

STEP	PROCEDURE
1	Referring to Figures 4-12 and 5-10, set the controls as follows: SF: BRDG (for bridging listen) TLP: LINE or DROP to suit the side of the circuit being monitored.
2	Patch to the circuit on test, 4-wire send or receive, or the monitor jack as required.
3	Patch the telephone set into the Tel Set jack on the TALK/LISTEN panel.
4	Operate the SF LISTEN RCV CKT pushbutton. NOTE When the correct TLP LINE or DROP push-button is operated, the telephone will now listen at a 0 dBm0 level.

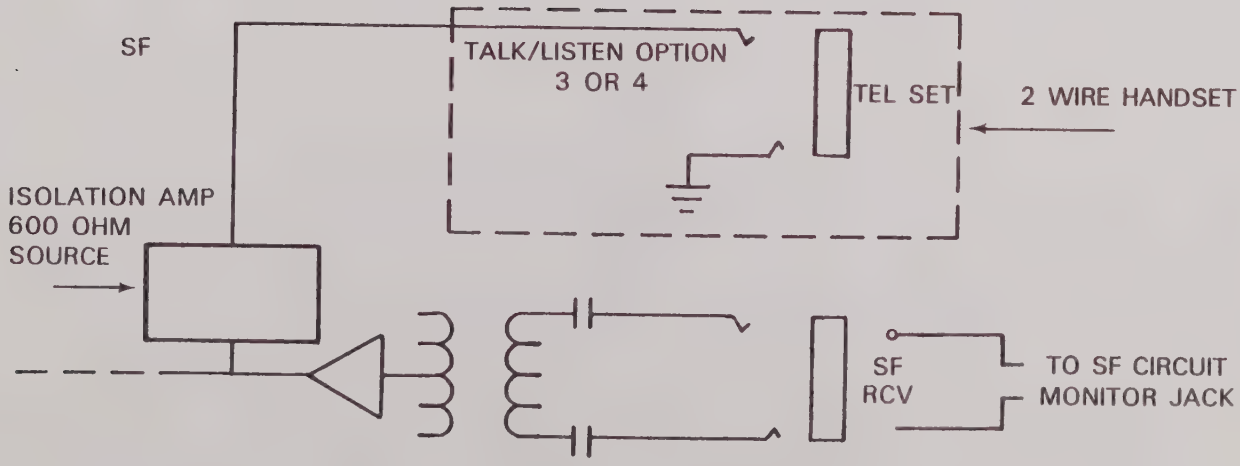

Figure 5-10. Test Setup for SF Listen Only With Talk/Listen

Table 5-11. Using Talk/Listen Option 3 or 4 for Transmission and Noise Measurements on Loop/B&G Circuits

STEP	PROCEDURE
1	Referring to Figures 4-12 and 5-9, patch the TMS to the Talk/Listen jack using a standard 310 to 310 type patch cord.
2	Set controls as follows: LOOP/B&G: OFF HOOK SEND LOOP RES: 0 SEND LEAK NETWORK: 0
3	When the LOOP/B&G TALK/LISTEN SEND CKT pushbutton is pressed, the TMS is connected directly across the Loop/B&G circuit. Level and Noise measurements can be made directly.

Table 5-12. Using Talk/Listen Option 3 or 4 for Transmission and Noise Measurements on SF Circuits

STEP	PROCEDURE
1	Referring to Figures 4-12 and 5-10, patch the TMS to the Talk/Listen jack.
2	Set controls as follows: SF: BRDG (for bridging listen) TLP: LINE or DROP, to match the side of the circuit being monitored
3	Select the desired functions on TMS. NOTE The SF LISTEN RCV CKT measurement is at a 0 dBm0 point, Line measurements are attenuated by 7 dB, and Drop measurements are amplified by 16 dB.

5.04 USING THE MF/DTMF COMM PANEL (OPTION 13)

The MF/DTMF Communications Panel is used for:

- Talking and Listening on 2-wire Loop, B&G, 4-wire SF, 2-wire or 4-wire DX, and 2/4-wire E&M circuits.
- Generating DTMF or MF tones for dialing over 2-wire Loop, B&G, 4-wire SF, 2-wire or 4-wire DX, and 2/4-wire E&M circuits.
- Measuring transmission levels and noise on 2- and 4-wire circuits by plugging a TMS into the TMS SEND and RCV jacks.

Dialing to a milliwatt test number provides loss measurements. Dialing to a quiet termination gives noise measurements.

Option 13 requires a telephone headset with a dual tip/sleeve plug for talking purposes.

Table 5-13. Using MF/DTMF COMM PANEL on Loop/B&G Circuits

STEP	PROCEDURE
1	Referring to Figures 5-11, 5-12, 5-13, patch the circuit under test to the LOOP/B&G SEND jack and set the controls as follows: LOOP/B&G SEND: ON HOOK LOOP or B&G as required by the circuit under test SEND PPS: 10 SEND % BRK: 58 SEND LOOP RES: 0 SEND LEAK NETWORK: 0 SEND MODE: DIAL PULSE APPLICATION: LOOP
2	To dial DTMF, operate the SEND MODE DTMF pushbutton.
3	Operate OFF HOOK & DIAL and listen for a dial tone. Press *, enter the desired number, then press # on the Model 9361B keypad to call up a line for further transmission or signaling tests.
4	To dial MF, operate the SEND MODE MF pushbutton.
5	Access a register using local practices. Press *, enter the desired number, then press # on the Model 9361B keypad. The instrument automatically inserts KP and ST with the dialed MF digits.
6	To talk over the circuit under test, connect a 4-wire headset to the HEADSET jack (the headset plug will work plugged in either way).
7	To send a tone over the circuit, patch an oscillator to the TMS SEND jack.
8	To measure the level or noise on a circuit, patch a TMS to the TMS RCV jack and proceed according to standard practices.

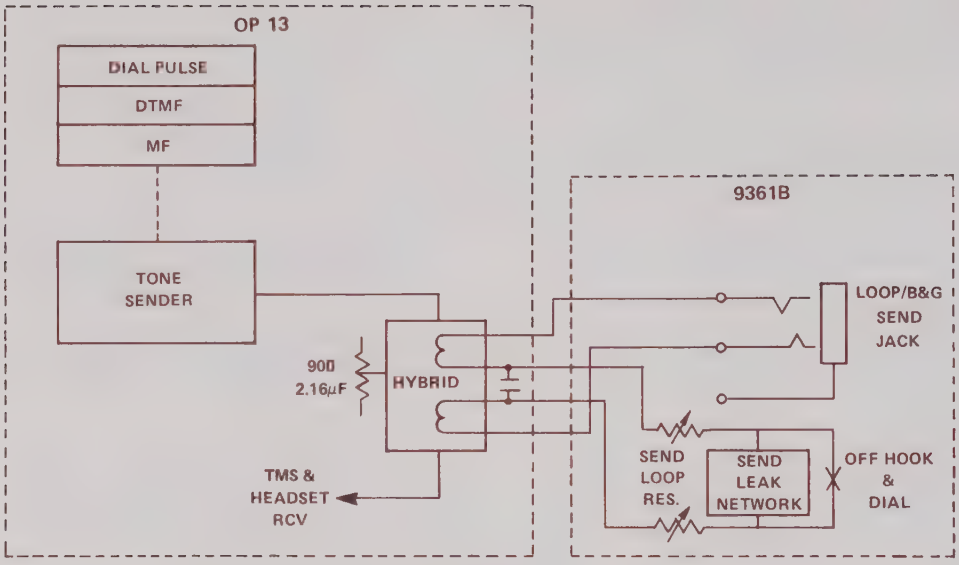

Figure 5-11. MF/DTMF on Loop/B&G

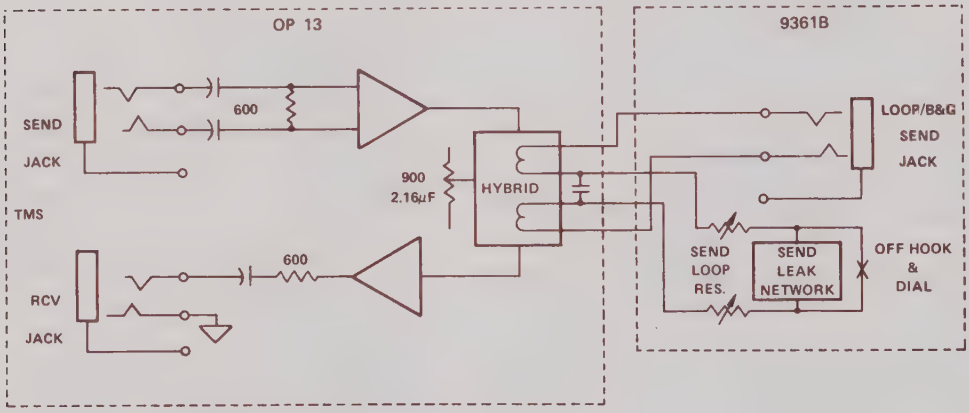

Figure 5-12. Transmission Measurement on Loop/B&G

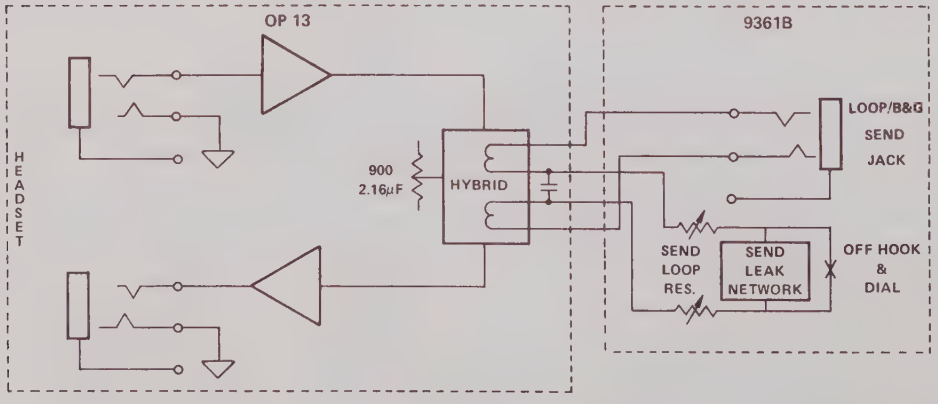

Figure 5-13. Headset on Loop/B&G

Table 5-14. Using MF/DTMF COMM PANEL on SF Circuits

STEP	PROCEDURES
1	Referring to Figures 5-14, 5-15, and 5-16, patch the circuit under test to the SF SEND and RCV jacks. Set the controls as follows: SF: BRDG MON: out TLP: LINE or DROP to suit the side of the circuit being tested. SEND: ON HOOK SEND MODE: MF SEND: SF/DX APPLICATION: SF/DX
2	To send MF with SF supervision, operate the SEND MODE MF push-button.
3	Operate SF OFF HK and watch the CKT IDLE indicator for a wink or off-hook indication.
4	Press *, enter the desired number, then press # on the Model 9361B keypad. The instrument automatically inserts KP and ST with the dialed MF digits.
5	To talk on a 4-wire SF circuit, connect a headset to the HEADSET jack (the headset plug will work plugged in either way).
6	To send a test tone on the circuit patch an oscillator to the TMS SEND jack.
7	To measure the level or noise on a circuit patch a TMS to the TMS RCV jack and proceed according to standard practices. NOTE The levels transmitted and received through the SF panel are coordinated by the setting of the TLP controls. All readings are in dBm0. See page 3-2 and 3-3.

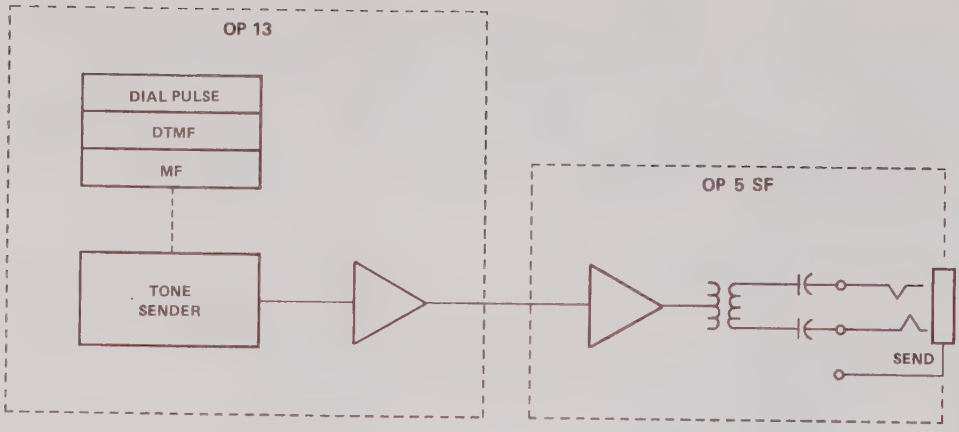

Figure 5-14. MF Signaling with SF Supervision

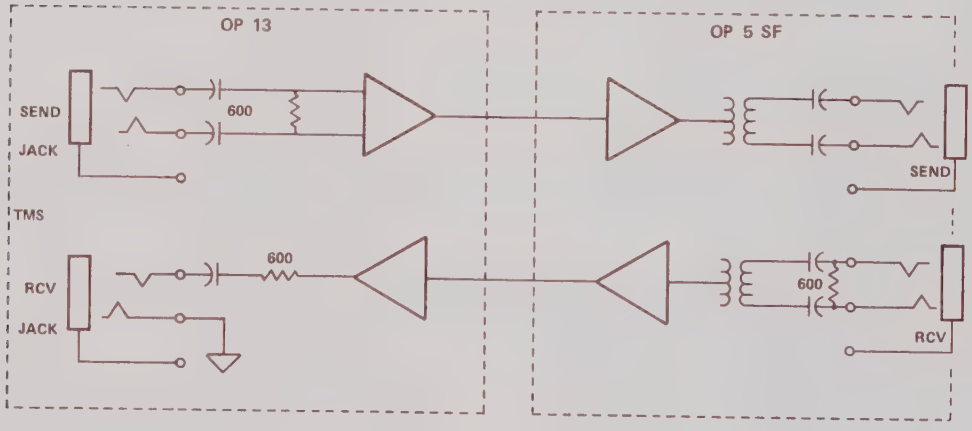

Figure 5-15. Transmission Measurement on 4-Wire Circuits

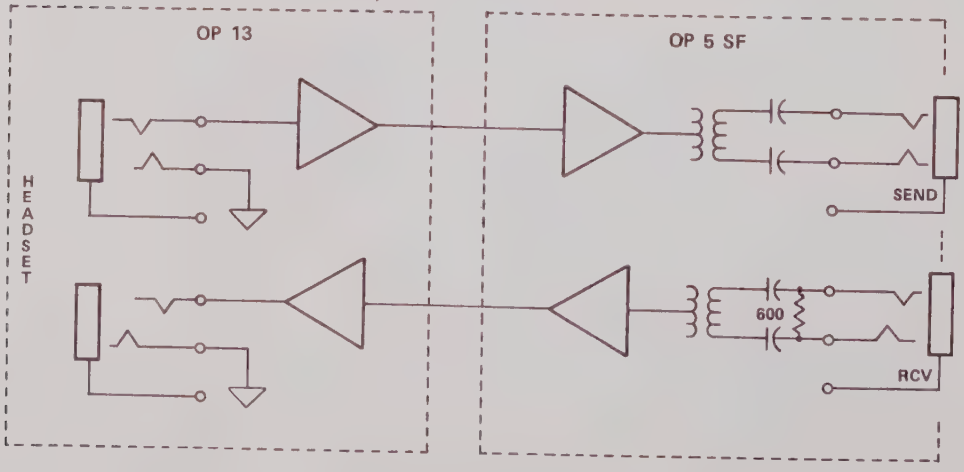

Figure 5-16. Headset on 4-Wire Circuits

Table 5-15. Using MF/DTMF COMM PANEL on 2-Wire E&M Circuits

STEP	PROCEDURE
1	Referring to Figures 5-11, 5-12 and 5-13, also Figures 6-6 or 6-7, patch the tip and ring to the Loop SEND jack and E and M to the LINE or DROP jacks on the E&M panel as required. Set the controls as follows: SEND: E&M RECEIVE: E&M DISPLAY: PPS or %BRK as desired for the test LOOP/B&G OFF HK & DIAL E&M ON HK SEND MODE: MF APPLICATION: LOOP
2	To send MF on a 2-wire circuit with E&M, press *, and enter the desired number. Operate CKT SPLIT TWD LINE or DROP as required. On the E&M panel operate OFF HK & DIAL. Watch the E&M supervision indicators (as applicable) for a wink or off-hook indication. Press # on the Model 9361B keypad. The instrument automatically inserts KP and ST with the dialed MF digits.
3	To talk on the Loop/B&G circuit, connect a headset to the HEADSET jack (the headset plug will work plugged in either way). See Figure 5-13.
4	To send a test tone on the circuit, patch an oscillator to the TMS SEND jack. See Figure 5-12.
5	To measure the level or noise on a circuit, patch a TMS to the TMS RCV jack and proceed according to standard practices. See Figure 5-12.

Table 5-16. Using MF/DTMF COMM PANEL on 4-Wire E&M Circuits

STEP	PROCEDURE
1	Referring to Figures 5-14, 5-15, 5-16 and 6-6 or 6-7, patch the 4-wire circuit to the SEND and RCV jacks on the SF panel. Patch the circuit E&M to the LINE or DROP E&M jacks as required. Set the controls as follows: 9361B Mainframe SEND: E&M RECEIVE: E&M DISPLAY: PPS or %BRK, as desired for test E&M: SEND: ON HK LOOP/B&G (if not equipped with Option 5) OFF HK & DIAL In SF (if equipped with Option 5) BRDG MON: Out TLP: LINE or DROP, to suit the side of the circuit under test. SEND: OFF HK & DIAL MF/DTMF COMM PANEL SEND MODE: MF APPLICATION: SF/DX, if equipped with Option 5; otherwise, LOOP.
2	On the E&M panel, to send MF with E&M Supervision if the Model 9361B is equipped with Option 5: a. Operate MON THRU. b. Operate ON HK. c. Operate INTERFACE TYPE I, II, or III. d. Split to LINE or DROP as required by the circuit. e. Operate OFF HK & DIAL. Watch the supervision indicators for a wink or off-hook indication. Press *, enter the desired number, then press # on the Model 9361B keypad to call up a line for further transmission or signaling tests. The instrument automatically sends ST and KP with MF digits.
3	To send MF with E&M supervision if the 9361B is not equipped with Option 5, patch the LOOP/B&G SEND jack to the facility line or drop jacks as desired.
4	Use the E&M procedure described above to seize the circuit.
5	Press # on the Model 9361B keypad to outpulse the MF digits entered in step 1. The instrument automatically inserts KP and ST signals.
6	To talk on a 4-wire circuit with E&M supervision, connect the circuit to the SF SEND and RCV jacks (if equipped with Option 5). See Figure 5-15.

Table 5-16. Using MF/DTMF COMM PANEL on 4-Wire E&M Circuits (Continued)

STEP	PROCEDURE
7	Connect a 4-wire headset to the COMM PANEL HEADSET jacks (the headset plug will work plugged in either way).
8	To talk only on a 4-wire circuit with E&M supervision when the 9361B is not equipped with Option 5, patch the LOOP/B&G SEND jack to the transmit side of the circuit under test. See Figure 5-13.
9	To listen only on a 4-wire circuit with E&M supervision when the 9361B is not equipped with Option 5, patch the LOOP/B&G SEND jack to the receive side of the circuit under test. See Figure 5-13.
10	To send an oscillator test tone on a 4-wire circuit with E&M supervision and the 9361B is equipped with Option 5, patch the SF SEND and RCV jacks to the circuit under test. See Figure 5-15.
11	Connect an oscillator to the TMS SEND jack.
12	To measure received level or noise on a 4-wire circuit with E&M supervision and Option 5 is equipped, patch the SF SEND and RCV jacks to the circuit under test. See Figure 5-15.
13	Patch a TMS to the TMS RCV jack and proceed according to standard practices.

SECTION VI

ON-LINE OPERATING PROCEDURES

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6.01 GENERAL

This section describes how to make Send and Receive measurements for E&M, Loop, B&G, and SF circuits. The Model 9361B can be bridged across or it can terminate a circuit and measure actual circuit conditions.

The send and receive circuits of the Model 9361B operate independently, allowing them to work with different types of signaling at the same time. For example, the sender can be set for E&M, and the receive selected for SF. Any type of signaling can be selected for either send or receive circuits.

For E&M trunks, the Model 9361B can split the circuit and send to or receive from the line or drop as shown below.

Send	LINE	DROP	LINE	DROP
Receive	LINE	DROP	DROP	LINE

Reverse supervision is available, allowing the test set to be split toward the line while controlling ON and OFF HOOK toward the drop, or the other way around.

When equipped with the Communications Panel (Option 13), the Model 9361B can outpulse MF and DTMF on 2- or 4-wire circuits. This option also includes the capability of making transmission measurements with an external TMS connected to the Model 9361B.

When equipped with the DX Adapter (Option 14), the Model 9361B can send or receive 2- or 4-wire DX signals from the near or distant end. With the DX Adapter, the Model 9361B can be used to detect A/B lead reversal and to determine correct line resistance and capacitive balance on both 2-wire and 4-wire DX circuits.

6.02 E&M INTERFACE TYPES

(A) Electro-Mechanical Switching Offices: Type I

Over the years, electro-mechanical telephone offices have used what is called E&M Type I Interface. The Model 9361B provides all the interface connections for the Type I including Battery and Ground (B&G) on the M lead and Ground and Open (G&O) on the E lead to represent ON and OFF HOOK conditions (see Figures 6-1 and 6-2).

(B) Electronic Switching Offices: Types II & III

The E&M interface circuits in electronic switching offices are susceptible to extraneous signals such as battery voltage differences and power line induction. To prevent these unwanted signals from being picked up, the E&M signal paths in electronic switching offices are "looped" so that there is only one ground point and one battery feed point per E&M circuit.

There are two E&M conventions in use for electronic switching applications, called E&M Type II and E&M Type III in accordance with AT&T Publication "Notes on Direct Distance Dialing," 1975 Edition (see Figures 6-3 and 6-4).

The test position appearance of Type II and III E&M signals is still 2-wire, since the loopback paths are not brought out (see Figure 6-4). However, if a signaling test set is used on a Type II or III E&M circuit, it must have the correct interface circuits; otherwise the level of the signaling pulses will be incorrect. Similarly, the receive circuits must have the correct interface to measure the received pulses accurately. The Model 9361B selects the appropriate interface circuits involved.

(C) Other Electro-Mechanical Switching Offices: Preset

In addition to the above interface types, Model 9361B also provides a PRESET position that is used to accommodate to individual office situations:

The E lead can be set to:
Ground and Open (G&O) or
Ground and Battery (G&B).

The M lead can be set to:
Battery and Ground (B&G),
Battery and Open (B&O), or
Ground and Open (G&O).
(Option 7 must be ordered if M lead G&O is required.)

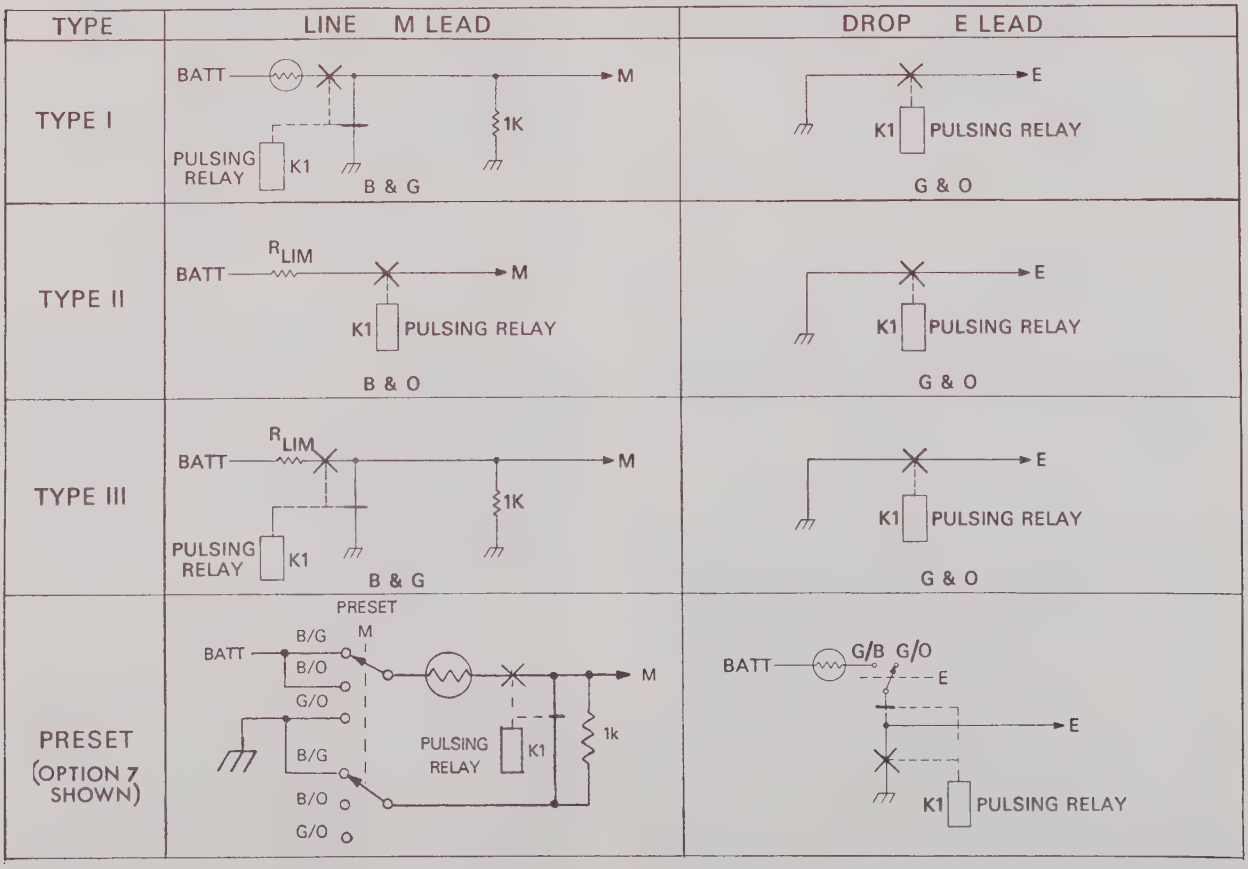

Figure 6-1. E&M Interface Types, Toward Line and Toward Drop

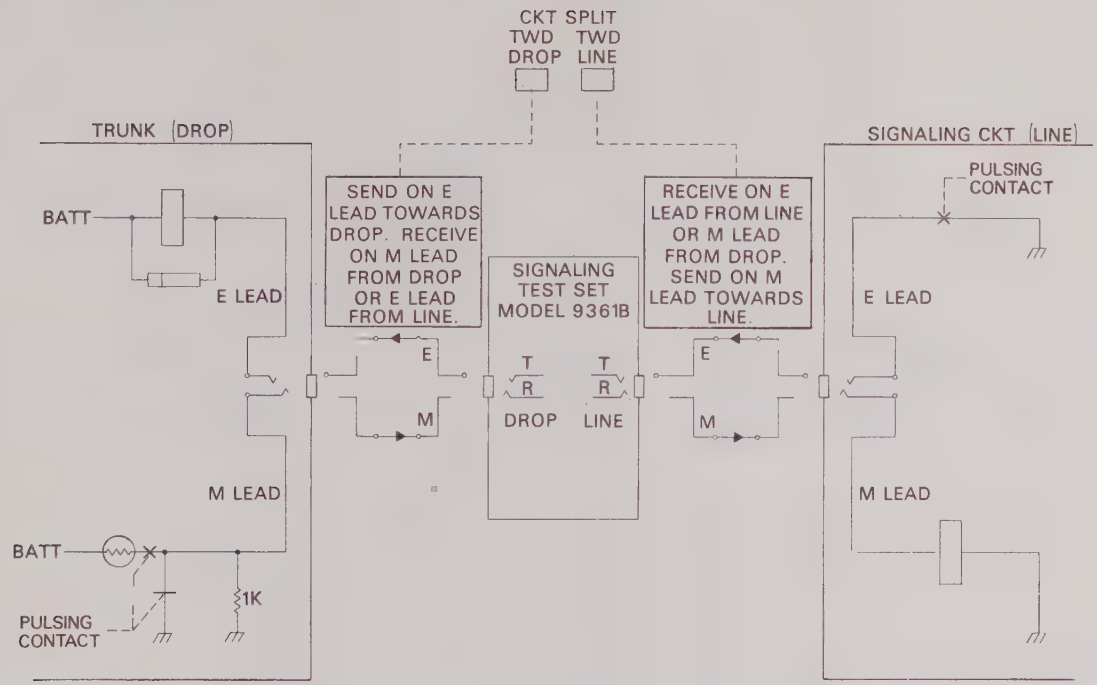

Figure 6-2. E&M Interface Type I Conditions

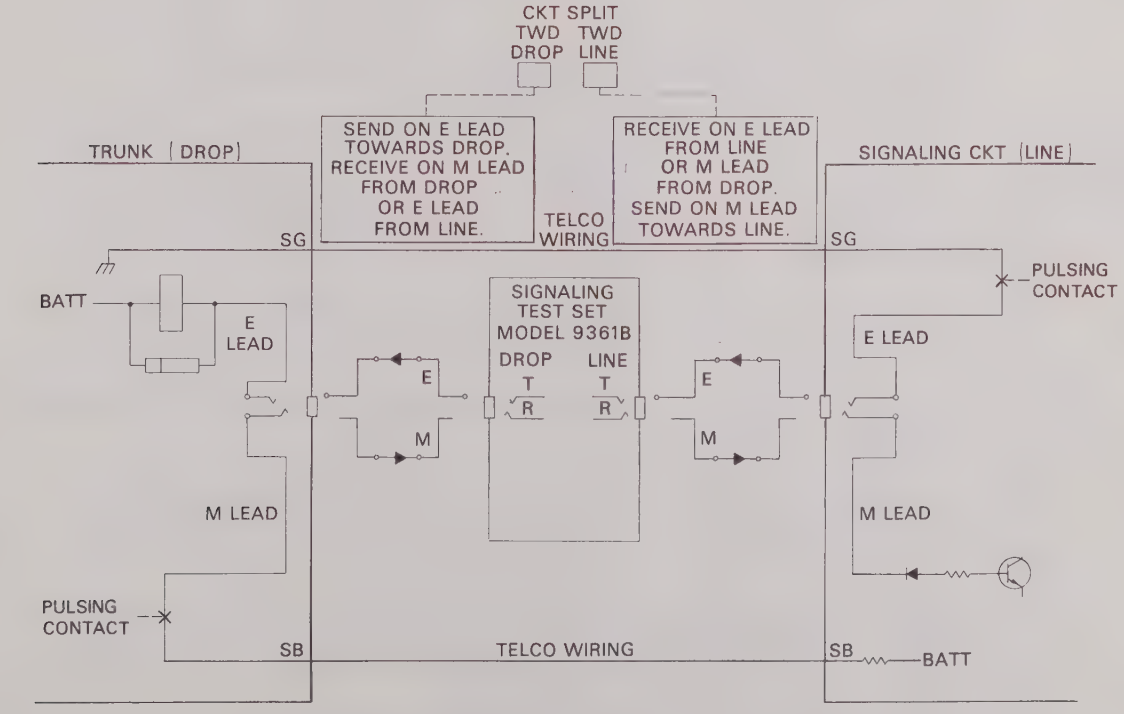

Figure 6-3. E&M Interface Type II Conditions

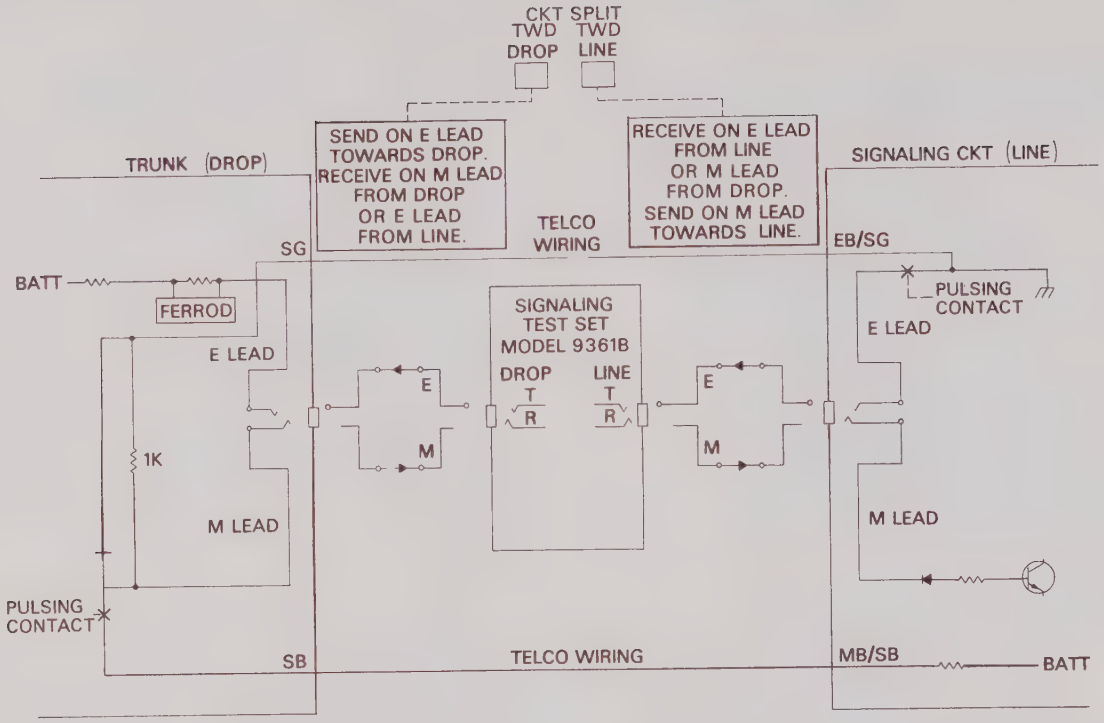

Figure 6-4. E&M Interface Type III Conditions

Table 6-1. Supervision, Monitoring, and Traffic Signaling Measurements on E&M Trunks

STEP	PROCEDURE
1	Refer to Figure 6-5. Determine the type of E&M circuit being tested (see paragraph 6.02).
2	Select the RECEIVE E&M and E&M MON THRU pushbuttons. Select the desired INTERFACE TYPE pushbutton.
3	Patch from the LINE jack toward the line equipment. Patch from the DROP jack toward the drop equipment.
4	You are now looping through the Signaling Test Set and monitoring supervision on a high-impedance basis, as displayed by the SUPV LINE and DROP indicators.
5	Bridging signaling measurements can be made from the Line (E lead) by selecting the RCV FROM LINE pushbutton, or from the Drop (M lead) by selecting the RCV FROM DROP pushbutton.
6	Select the desired DISPLAY measurement pushbutton.

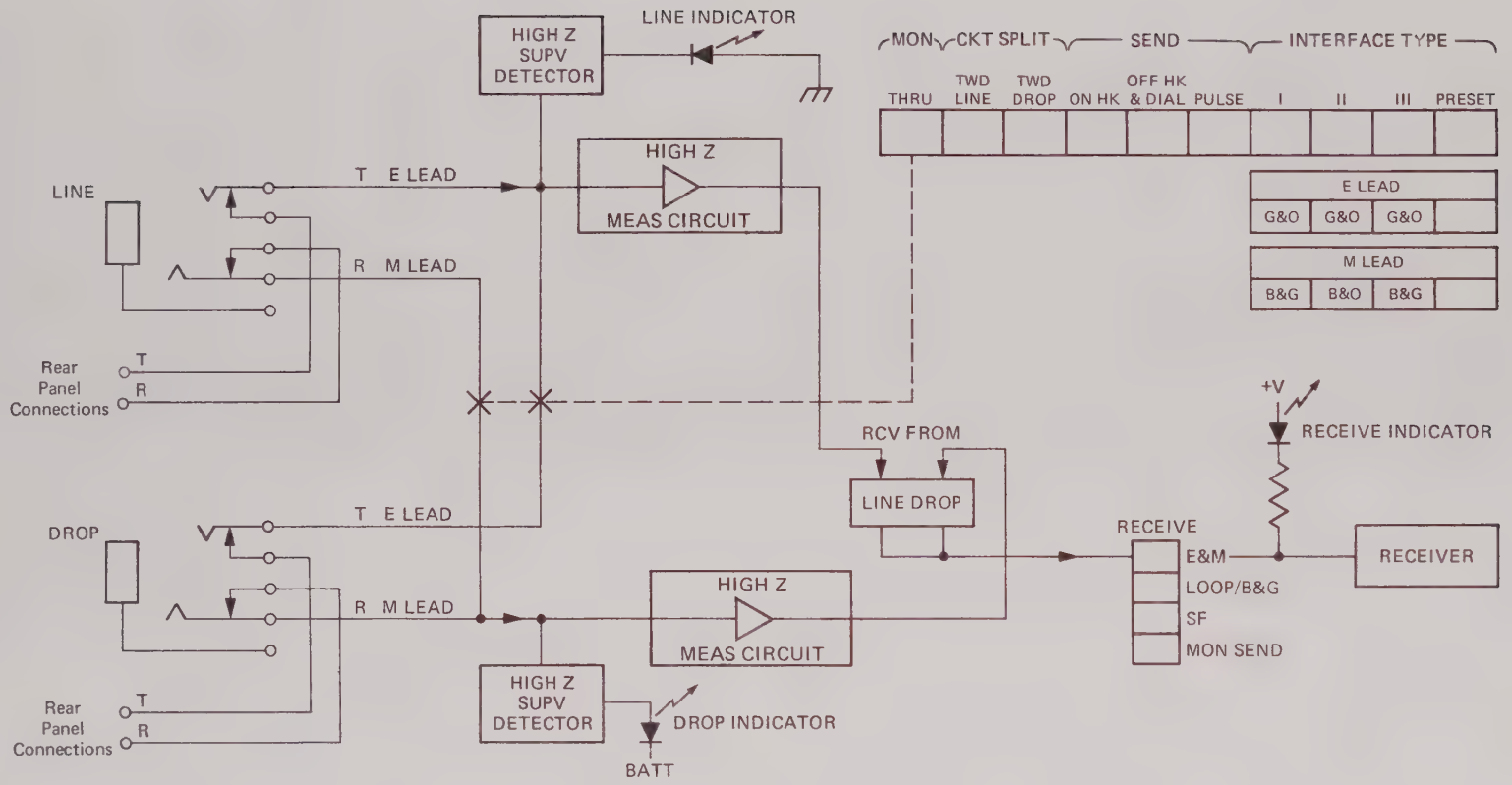

Figure 6-5. Bridging Monitor of E&M

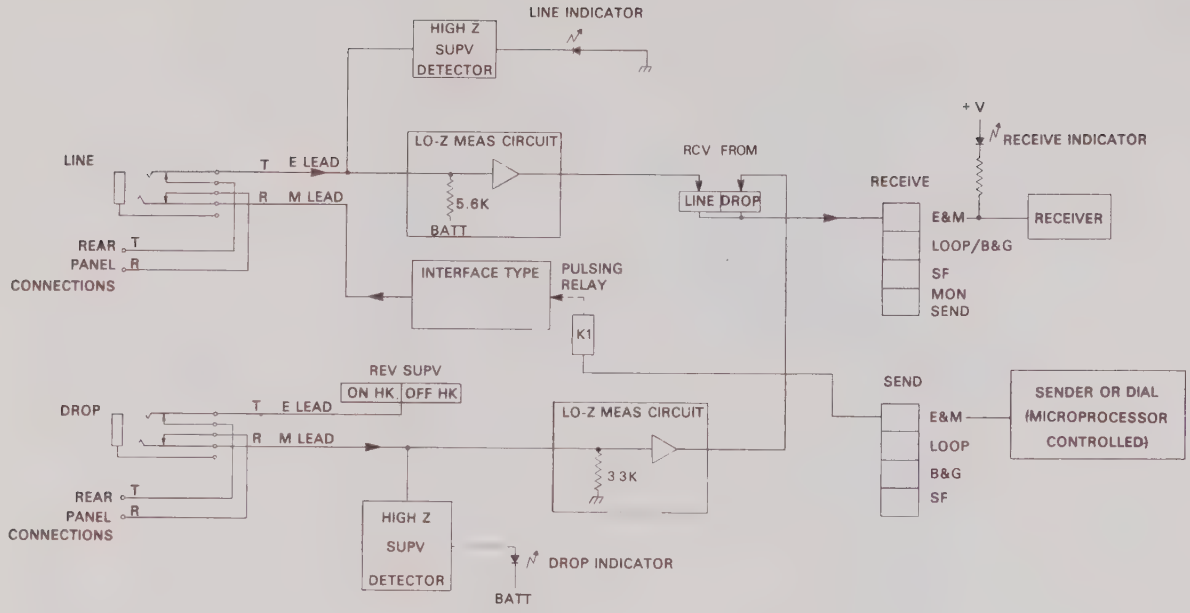

Figure 6-6. CKT SPLIT TWD LINE Pushbutton Selected

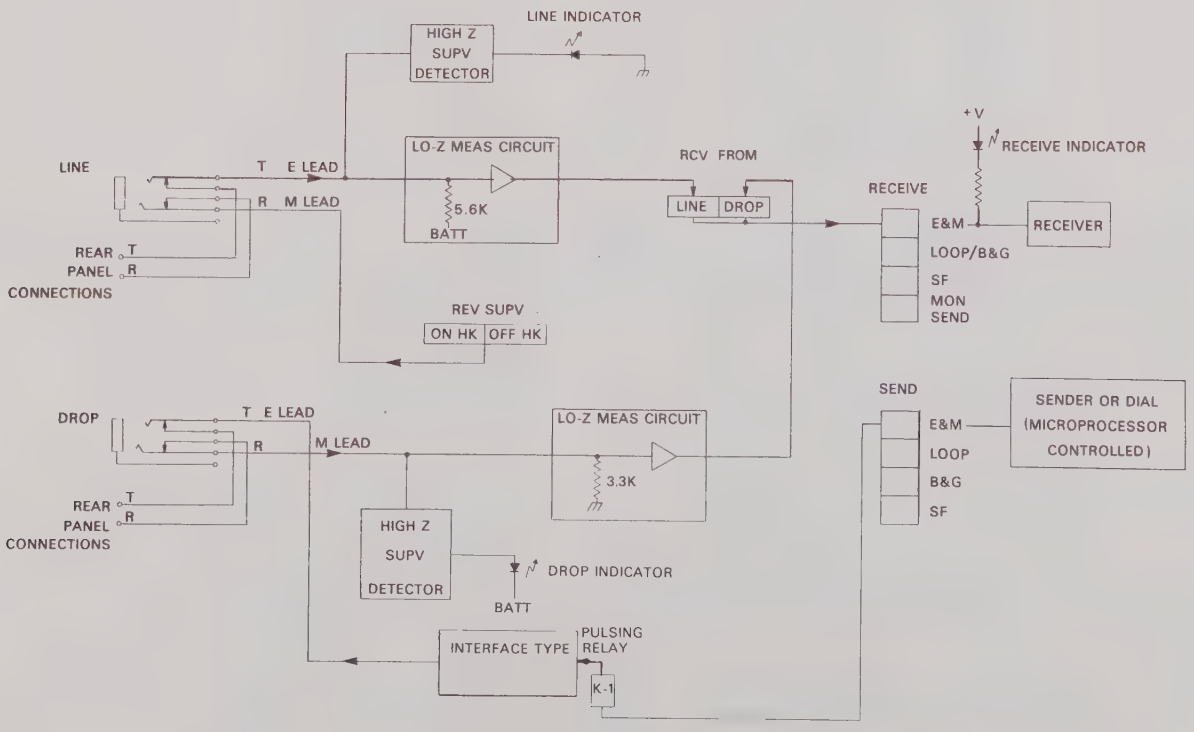

Figure 6-7. CKT SPLIT TWD DROP Pushbutton Selected

Table 6-2. Sending on an E&M Trunk

STEP	PROCEDURE
	Refer to Figure 6-6 (to Line) or 6-7 (to Drop).
1	Select the SEND E&M, E&M MON THRU, and SEND ON HK pushbuttons. Select the desired INTERFACE TYPE pushbutton.
2	Patch from the LINE jack toward the line equipment. Patch from the DROP jack toward the drop equipment.
3	You are now looping through the Signaling Test Set and monitoring supervision on a high-impedance basis, as displayed on the SUPV LINE and DROP indicators.
4	Check that both the SUPV LINE and DROP indicators are lit, indicating an idle circuit condition. (If not lit, traffic may be disturbed.)
5	Select the CKT SPLIT TWD LINE or DROP pushbutton. Select the REV SUPV ON HK or OFF HK pushbutton, as desired (supervision toward the LINE equipment).
6	Press the E&M SEND OFF HK & DIAL pushbutton. Observe that a "wink" is obtained on the SUPV DROP indicator, indicating that a sender has been connected.
7	Dial at the desired PPS, % BRK, and inter-digital time using the keypad, or send continuous pulses by selecting the E&M SEND: PULSE pushbutton.

Table 6-3. Receiving From an E&M Trunk

STEP	PROCEDURE
	Refer to Figure 6-6 (to Line) or 6-7 (to Drop).
1	For bridging measurements, select the MON THRU pushbutton. For terminated measurements, select the CKT SPLIT TWD LINE or DROP pushbutton.
2	Patch from the LINE jack toward the line equipment. Patch from the DROP jack toward the drop equipment.
3	When the MON THRU pushbutton is selected, you are looping through the Signaling Test Set on a high-impedance basis. When the CKT SPLIT TWD DROP pushbutton is selected, the receivers are terminated. The LINE and DROP indicators are indicating the supervision status.
4	Select E&M RCV FROM LINE or DROP pushbutton.
5	Select the RECEIVE E&M pushbutton. Select the desired DISPLAY measurement pushbutton.

Table 6-4. E&M Operation: Sending Code 103 Toward the Line or Drop

STEP	PROCEDURE
	Refer to Figures 6-6 and 6-7.
1	Select the SEND E&M, E&M MON THRU, and E&M SEND ON HK pushbuttons. Select the desired INTERFACE TYPE pushbutton.
2	Patch from the LINE jack toward the line equipment. Patch from the DROP jack toward the drop equipment.
3	You are now looping through the Signaling Test Set and monitoring supervision on a high-impedance basis, as displayed on the SUPV LINE and DROP indicators.
4	Check that both the SUPV LINE and DROP indicators are lit, indicating an idle circuit condition. (If not lit, traffic may be disturbed.)
5	Select the CKT SPLIT TWD LINE or DROP pushbutton. Select the REV SUPV ON HK or OFF HK pushbutton, as desired.
6	Press the SEND OFF HK & DIAL pushbutton. Observe that a "wink" is obtained on the SUPV LINE or DROP indicator, indicating that a sender has been connected.
7	Dial digits 103 using the keypad at the desired PPS, % BRK, and interdigital time.
8	On seizure, the trunk under test returns an off-hook condition (SUPV LINE or DROP indicator extinguished).
9	Dial a digit 1. This provides a ring forward (re-ring) signal.
10	The trunk under test now returns an on-hook signal (SUPV LINE or DROP indicator lit).
11	Dial a digit 1 again. This provides a second ring forward (re-ring) signal.
12	The trunk under test returns a 120 IPM flash as indicated by the SUPV LINE or DROP indicator.

6.03 MAKING E&M MEASUREMENTS

CAUTION

When making E&M measurements using the AC Power Converter, remove the link on the 9361B rear panel; then connect an office ground to the DC GRD binding post.

6.04 MAKING LOOP/B&G MEASUREMENTS

Make the connections for the required measurements on Loop or B&G for send and receive as shown. Figures 6-9 and 6-10 show connections to a Loop and B&G circuit respectively.

NOTE

When making bridging measurements, patch the RCV jack into the Monitor jack of the jackfield.

6.05 SELECTING THE CORRECT LOOP/B&G RCV INPUT

When making Loop or B&G receive measurements, the correct pushbutton should be selected. They are grouped under RCV INPUT on the LOOP/B&G panel, and are as follows:

-- BRDG (bridging)

-- TERM (terminating)

-- S-R (electronic relay)

-- A-Relay

Bridging Detector. This is used to make signaling measurements on a bridging basis on Loop or B&G circuits. The detector will operate on circuits with 1400 ohms maximum resistance on a dry loop, and 2800 ohms maximum resistance on a wet loop. The circuit under test must be terminated in a relay with loop current flowing. Measurements can be made of dial speed, % Break, and First Pulse distortion. The number the subscriber has dialed, digit by digit, is also displayed.

Terminating Detector. This is for "A-Relay Bypassed" measurements. The range of loop resistance is 1600 ohms maximum on a dry loop and 3200 ohms maximum on a wet loop. The terminating detector should not be used in the presence of a loop, leak, or protection circuit, since the % Break readings may not be accurate (although many Telco signaling practices ignore this fact).

The S-R Detector. This is used (a) to make measurements in the presence of a leak network, or (b) to make measurements with a contact protection circuit across the relay contacts being measured.

This detector detects the undisturbed pulse waveform, making it unnecessary to disconnect these networks. The detector operates with a loop resistance of 1200 ohms maximum for a dry loop, and 2400 ohms maximum for a wet loop.

The A-Relay. The A-Relay is used whenever the practice calls for an A-Relay measurement. The calibration of the A-Relay for % Break measurements is affected slightly by the battery voltage. The A-Relay in the Model 9361B Test Set is calibrated with exactly -48V applied to it. If the battery voltage is not at this level, and very accurate measurements are required, a correction factor can be obtained from Figure 6-8.

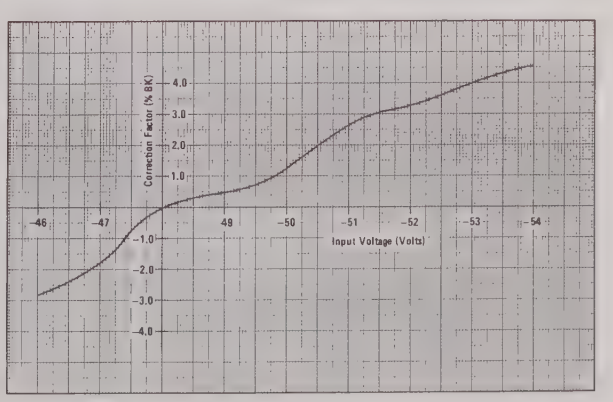

Figure 6-8. A-Relay Voltage Correction Factor (Typical)

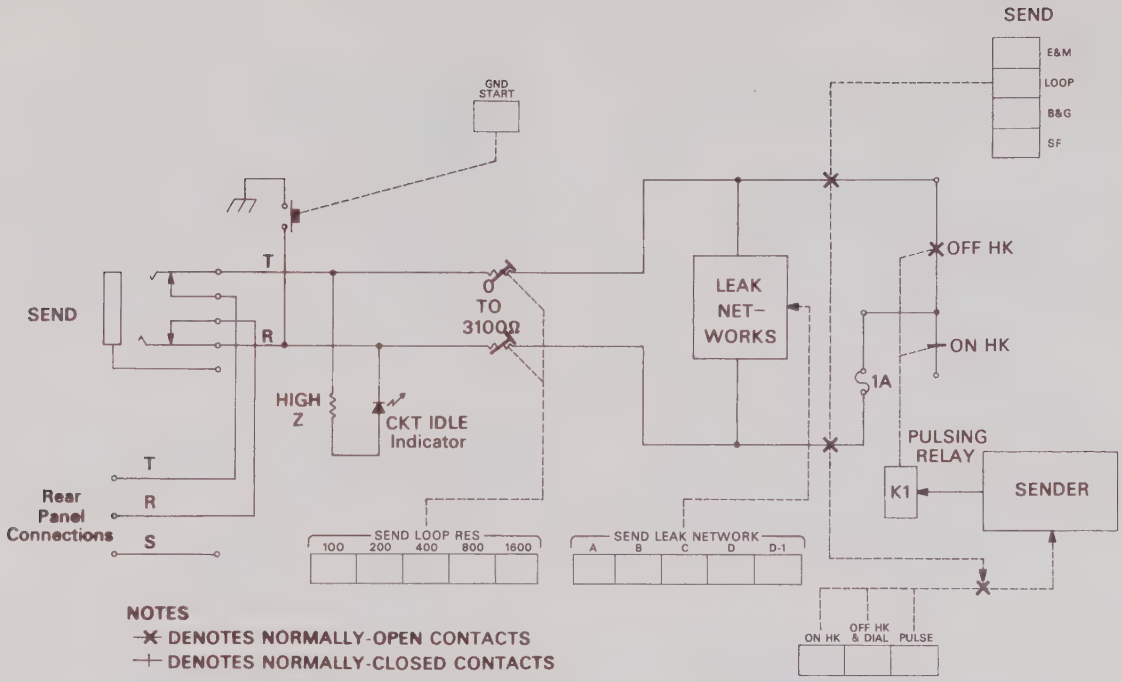

Figure 6-9. Send Loop Conditions

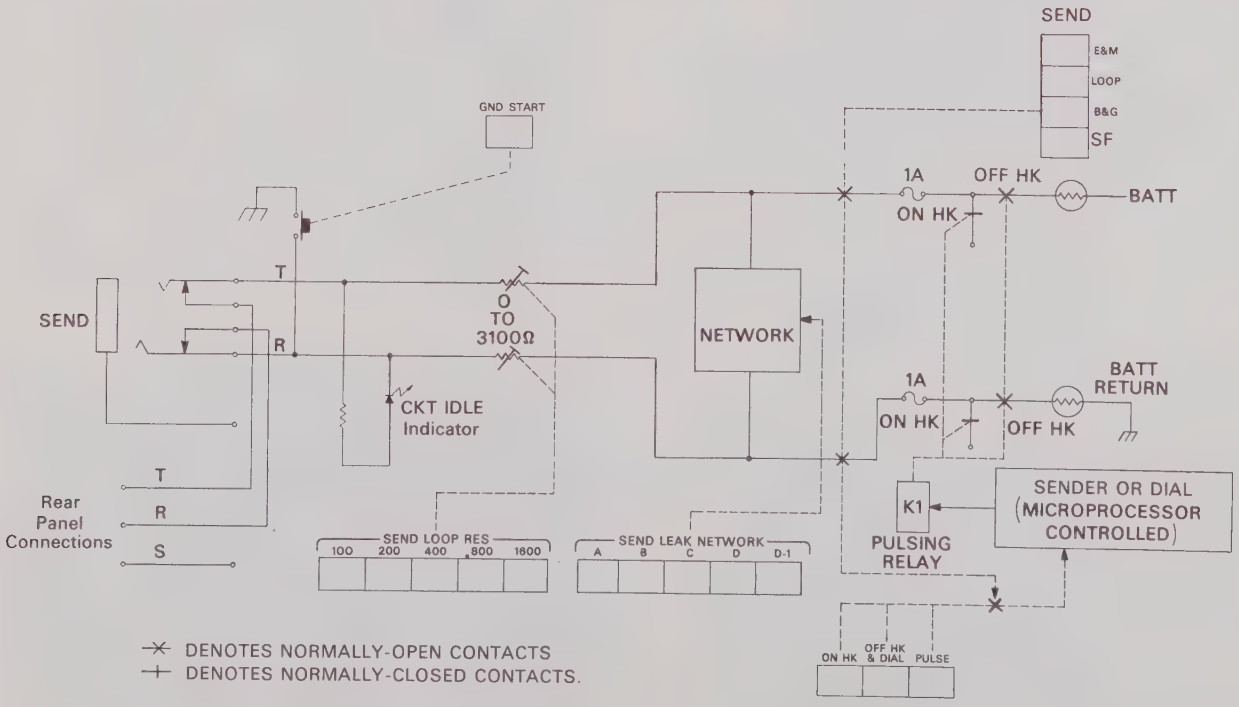

Figure 6-10. Send Battery & Ground Conditions

For example, if the battery voltage is -51.0 volts, the % BRK correction factor from Figure 6-8 is +2.8. Therefore, the correct A-Relay calibration is the nominal value, 60.5%, plus the 2.8% correction factor, which is 63.3% BRK.

6.06 SIGNALING TEST SET PRACTICES

If the Telephone Company Practice being used for signaling tests does not reference the WILTRON Test Set, Table 6-5 shows the Receive Input Detector to use to correlate with other manufacturers' signaling Test Sets.

Table 6-5. RCV Input Detector Selection

Signaling Test Set Manufacturer and Model #	Type of Loop Measurement Specified by Signaling Practice			
WILTRON 9361B	TERM	S-R	A-Relay	BRDG
Northeast Electronics 26B	A-Relay bypassed	Not available	A-Relay	Not available
Lenkurt 26600-M2	Not available	Solid State Relay Model 26600-M2 only	A-Relay	Not available
Western Electric 2B	Not available	Not available	LP2	Not Available
Western Electric 4A	Not available	S-R	LP2	Not available

Table 6-6. Supervision, Monitoring, & Traffic Signaling Measurements on Loop/B&G Trunks

STEP	PROCEDURE
	Refer to Figures 6-9 thru 6-13.
1	Select the RECEIVE LOOP/B&G and the RCV INPUT BRDG pushbuttons.
2	Patch from the RCV jack to the Loop Monitor jack on the jackfield or to the circuit to be monitored. The SLEEVE GND indicator shows whether the circuit is busy (ground applied to the Sleeve).
3	If the circuit under test provides battery on the Tip and ground on the Ring, select the T/R REV pushbutton.
4	Select the desired DISPLAY measurement pushbutton.

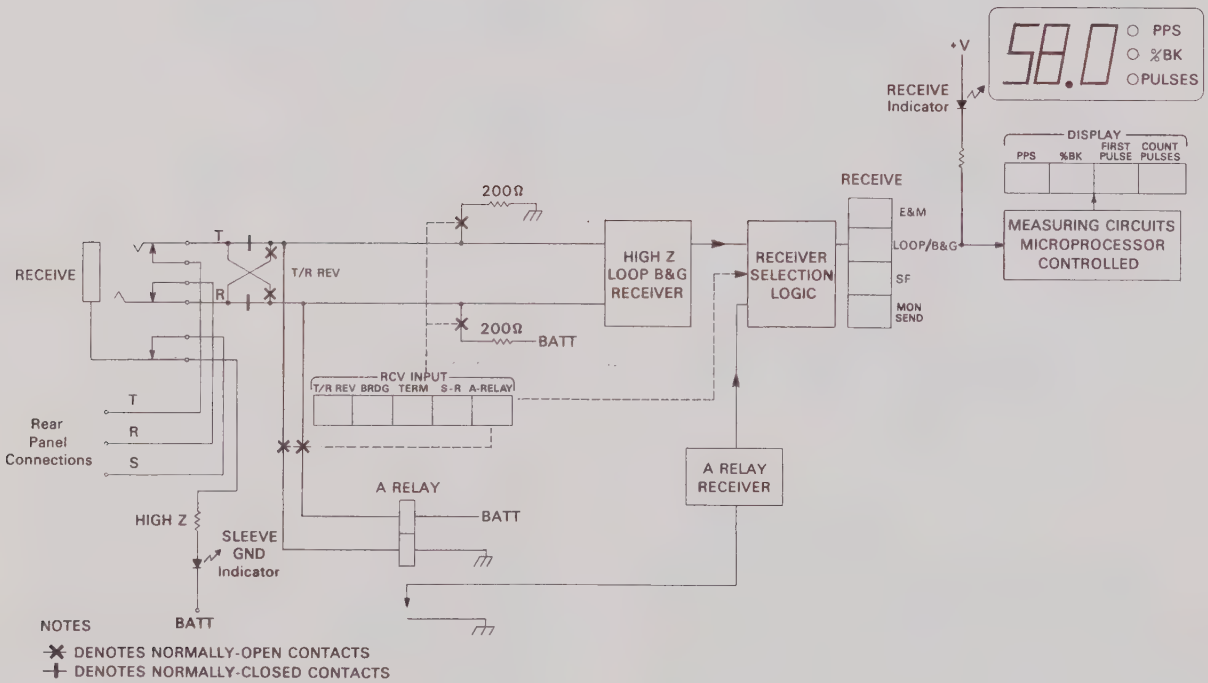

Figure 6-11. Receive Loop and B&G Conditions

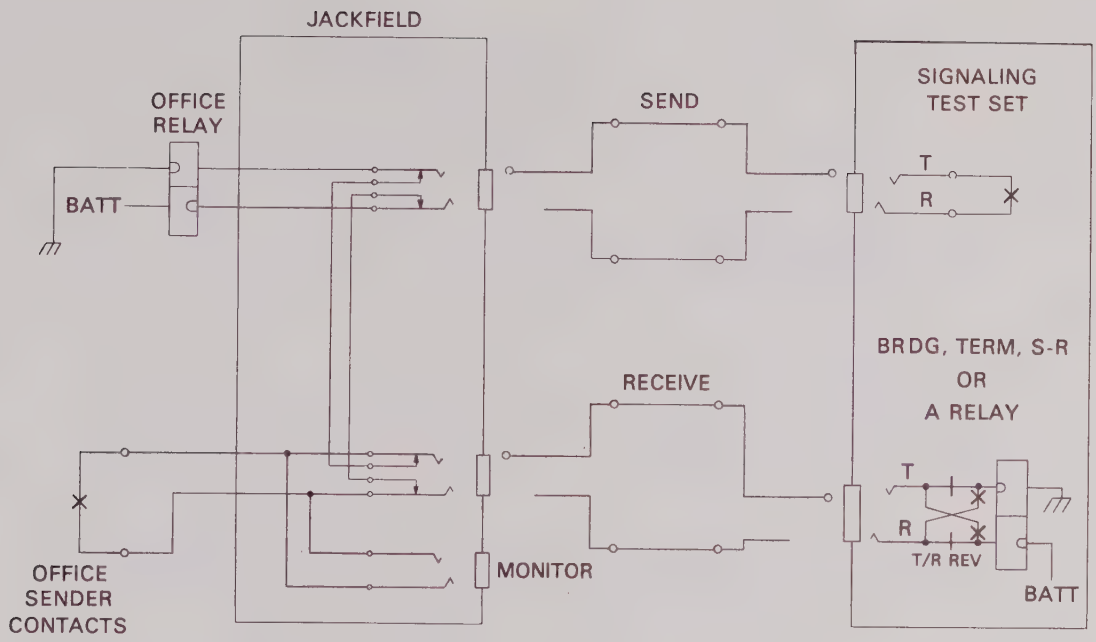

Figure 6-12. Loop Interface Diagram

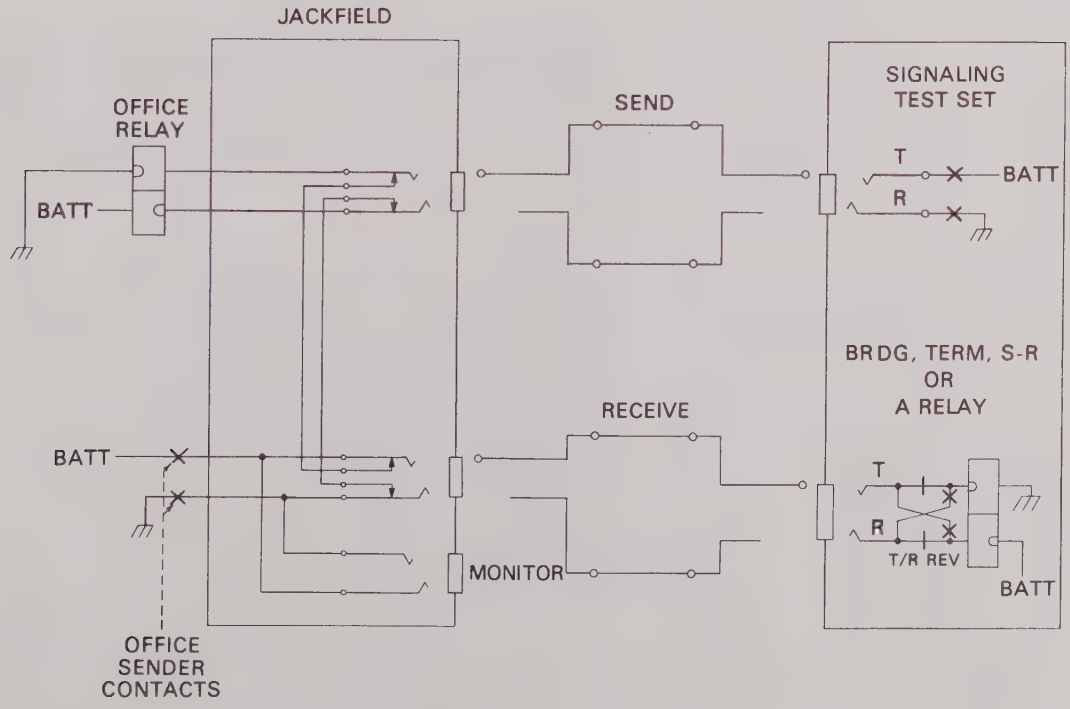

Figure 6-13. Battery & Ground Interface Diagram

Table 6-7. Sending Loop or B&G

STEP	PROCEDURE
	Refer to Figures 6-9 and 6-12 for Loop, and Figures 6-10 and 6-13 for B&G.
1	For dry loop sending, select the SEND LOOP pushbutton. For wet loop sending, select the SEND B&G pushbutton. Select the desired SEND LOOP RES or SEND LEAK NETWORK.
2	Select the LOOP/B&G ON HK pushbutton.
3	Patch from the LOOP/B&G SEND jack to the circuit to be pulsed. An idle receiver (battery on the Ring, ground on the Tip) lights the SUPV CKT IDLE indicator.
4	If the circuit under test requires a ground start, momentarily press the GND START pushbutton, and check for a "wink" on the SUPV CKT IDLE indicator. If loop start is required, select the LOOP/B&G OFF HK & DIAL pushbutton.
5	Dial at the desired PPS, % BRK and inter-digital time using the keypad, or send continuous pulses by selecting the LOOP/B&G SEND PULSE pushbutton.

Table 6-8. Receiving Loop or B&G

STEP	PROCEDURE
	Refer to Figure 6-11, 6-12, or 6-13.
1	Select the RECEIVE LOOP/B&G pushbutton.
2	When the circuit under test needs to be measured through an A-Relay, select the RCV INPUT A-RELAY pushbutton. For circuit tests using a resistance termination (A-Relay bypass), select the RCV INPUT TERM pushbutton. If contact protection is present on the circuit, select the S-R pushbutton.
3	If the circuit under test requires battery on the Tip and ground on the Ring, select the T/R REV pushbutton.
4	Patch from the RCV jack to the pulsing circuit. The SLEEVE GND indicator shows whether the circuit is busy (ground applied to the Sleeve).
5	Select the desired DISPLAY measurement pushbutton.

6.07 MAKING SF MEASUREMENTS

Option 5, the SF Adapter Panel, must be installed in order for SF measurements to be made. The sender and receiver in the SF Adapter operate independently, so that while the sender is being used, another type of signaling can be measured by the receiver, or the sender and receiver can operate on different circuits (see Figure 6-14).

Bridging measurements can also be made on SF allowing dial speed, % Break, and first pulse distortion to be measured. This also allows digits dialed to be identified. If no monitor jack is available when making bridging measurements, the SF sender and receiver can be plugged into splitting-type jacks, since when the MON BRDG (Monitor Bridge) button is pressed, the SEND AND RCV jack tip and ring leads are connected in the SF Adapter. Figures 6-15 and 6-16 show this method of connection. If a double plug is plugged into EQUIPMENT IN and DEMOD OUT, or MOD IN and EQUIPMENT OUT (Figure 6-17), the circuit is restored immediately by providing a path through the SF Adapter panel.

If the Model 9361B is equipped with the DX Adapter (Option 14), measurements may be made at the junction of SF and DX circuits. By selecting the DX ACTIVE SEND or RECEIVE pushbutton as required, signals may be sent on the DX circuit and received on the SF circuit, or received on the DX circuit and sent on the SF circuit (refer to paragraph 6.11).

NOTE

If the Model 9361B is equipped with Option 14, the DX ACTIVE SEND switch must be out to enable the SF sender; similarly, the DX ACTIVE RCV switch must be out to enable the SF receiver.

6.08 OPERATING AT TLP VALUES OTHER THAN +7 AND -16

Table 6-9a shows the range of ON HOOK, OFF HOOK, or PULSING LEVELS of the equipment toward the line or the drop, at +7 or -16 TLP, for the SF sender. Table 6-9b gives the power levels required to light the ON HOOK and OVERLOAD lights.

Table 6-10 explains how to change the sensitivity of the receiver and the transmitted power from the sender using combinations of the Line and Drop TLP pushbuttons, allowing the SF Adapter to send or receive almost any level of SF that may be required.

6.09 SF SEND/RECEIVE MEASUREMENTS

The following tables show the range of send and receive levels applicable to the WILTRON SF Adapter.

Table 6-9a. Sending SF Tones

LINE OR DROP TLP	PUSHBUTTON SELECTED		
	ON HOOK	OFF HOOK	PULSE
Sending toward LINE	-36 dBm calibrated. Adjustable to -48 dBm by TLP ADJ control.	No tone	-24 dBm calibrated. Adjustable to -36 dBm by TLP ADJ control.
Sending toward DROP	-13 dBm calibrated. Adjustable to -25 dBm by TLP ADJ control.	No tone	-1 dBm calibrated. Adjustable to -13 dBm by TLP ADJ control.

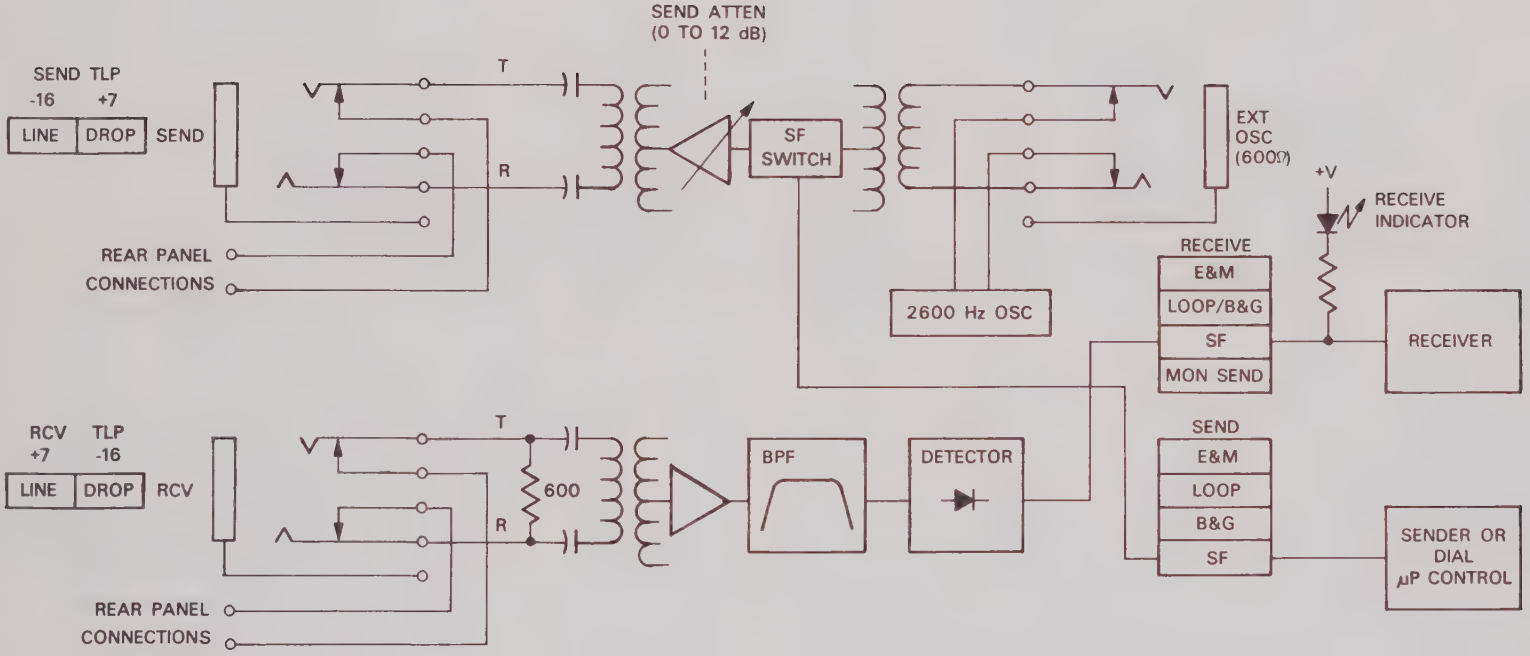

Figure 6-14. SF Adapter and 9361B

Table 6-9b. Receiving SF Tones

	PUSHBUTTON SELECTED	
	LINE (TLP = +7)	DROP (TLP = -16)
Minimum Input Level:		
For CKT IDLE (on hook) Indicator to light.	> -24 dBm	> -47 dBm
For RCV OVERLOAD Indicator to light.	> +7 dBm	> -16 dBm

Table 6-10. Selecting Send and Receive TLP's Other than +7 and -16

SF Adapter TLP Pushbutton Setting		SF SEND TLP Range	SF RCV Level Range
LINE	DROP		
IN	OUT	-16 dBm preset, adjustable on SEND ATTEN to -28 dB TLP.	+7 to -24 dBm
OUT	IN	+7 dBm preset, adjustable on SEND ATTEN to -5 dB TLP.	-16 to -47 dBm
IN	IN	+7 dBm preset, adjustable on SEND ATTEN to -5 dB TLP.	+7 to -24 dBm
OUT	OUT	-16 dBm preset, adjustable on SEND ATTEN to -28 dB TLP.	-16 to -47 dBm

For SF measurements at +7 and -16 TLP points, the first two pushbutton combinations are used.

For TLP conditions where the send and receive levels are not 23 dB apart, such as OCC interface points with telephone companies, use the third or fourth pushbutton combinations as required.

Table 6-11. SF Operation: SF Bridging Measurements Procedure

STEP	PROCEDURE
	Refer to Figures 6-15 and 6-16.
1	Select the RECEIVE SF pushbutton on the 9361B.
2	Select the MON BRDG on the SF Adapter panel.
3	Set the TLP Drop at -16, or Line at +7 as required.
4	Connect a dual 310-type cord into the SEND and RCV jack of the SF Adapter panel.
5	Connect the other end of the cord to the EQ IN and DEMOD OUT jacks, or the EQ OUT and DEMOD IN jacks.
6	If the circuit is idle, the CKT IDLE lamp will light. When the circuit is being pulsed, the Receive CKT IDLE lamp will flash. CAUTION The RCV OVERLOAD lamp must not flash, or the measurements will be invalid. See Table 6-10.
7	After the pulses have been received, select the required DISPLAY pushbuttons for PPS, % BRK, FIRST PULSE, or COUNT PULSES, as required.

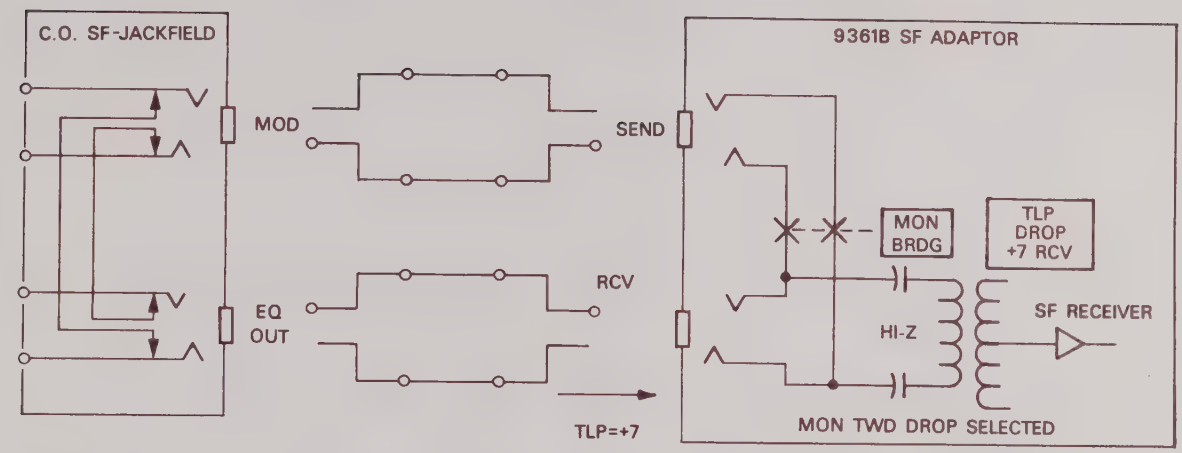

Figure 6-15. Monitoring the SF DROP Without a Monitor Jack

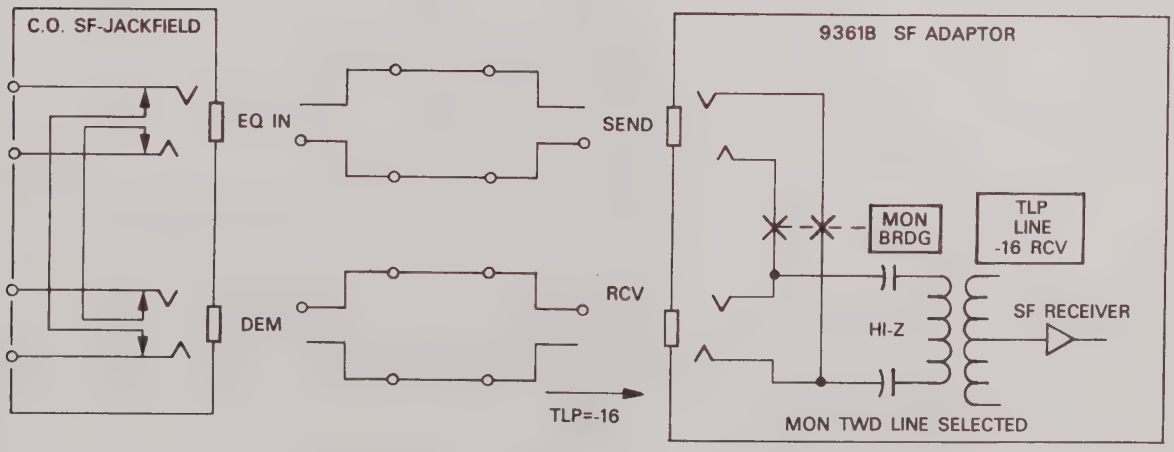

Figure 6-16. Monitoring the SF LINE Without a Monitor Jack

Table 6-12. Sending SF Toward the Drop or Line

STEP	PROCEDURE
	Refer to Figure 6-17.
1	Select the SEND SF pushbutton on the Model 9361B.
2	Select the TLP LINE or DROP pushbutton on the SF panel.
3	Select the SEND ON HK pushbutton on the SF panel. Check that the dB FROM SEND TLP control is set to zero and that the indicator is extinguished.
4	Patch from the SF panel SEND jack to the toward the Drop jack on the jackfield.
5	You are now sending the internal SF tone (2600 Hz) at an on hook level of -20 dBmO (-13 dBm Drop, -36 dBm Line). NOTE The send level can be reduced by up to 12 dB using the dB FROM SEND TLP control. When a frequency other than 2600 Hz is required, an external oscillator can be connected to the SF panel EXT OSC jack. A level of 0 dBm is required to obtain a send level of -20 dBmO (with the dB FROM SEND TLP control set to 0).
6	Press the SF panel SEND OFF HK & DIAL pushbutton.
7	Dial at the desired PPS, % BRK, and interdigital time using the keypad, or send continuous SF pulses by selecting the SF panel SEND PULSE pushbutton. The pulsing level is -8 dBmO (-1 dBm Drop, -24 dBm Line).

Table 6-13. Receiving SF From the Line

STEP	PROCEDURE
	Refer to Figure 6-17.
1	Select RECEIVE: SF on the Model 9361B.
2	On the SF panel, select the TLP: LINE pushbutton.
3	Patch from the SF panel RCV jack to the From Line jack on the jackfield.
4	You are now receiving from the Line on a terminated basis.
5	If the receive level exceeds 0 dBmO, the RCV OVERLOAD indicator on the SF panel will light. See Table 6-10 for corrective action.
6	Select the desired DISPLAY measurement pushbutton.

Table 6-14. Receiving SF From the Drop

STEP	PROCEDURE
	Refer to Figure 6-17.
1	Select the RECEIVE: SF pushbutton on the Model 9361B.
2	On the SF panel, select the TLP: DROP pushbutton.
3	Patch from the SF panel RCV jack to the From Drop jack on the jackfield.
4	You are now receiving from the Drop on a terminated basis.
5	If the receive level exceeds 0 dBmO, the RCV OVERLOAD indicator on the SF panel will light. See Table 6-10 for corrective action.
6	Select the desired DISPLAY measurement pushbutton.

Table 6-15. SF Operation: Sending Code 103 Toward the Line or Drop

STEP	PROCEDURE
	Refer to Figure 6-17.
1	Select the SEND SF pushbutton on the Model 9361B.
2	Select the TLP LINE or DROP pushbutton on the SF panel.
3	Select the SEND ON HK pushbutton on the SF panel. Check that the dB FROM SEND TLP control is set to zero, and that its indicator is extinguished.
4	Patch from the SF panel SEND jack to the DEMOD or EQ IN drop jack and from the RCV jack to the MOD or EQ OUT drop jack on the jackfield.
5	You are now sending the internal SF tone (2600 Hz) at a -20 dBmO level. NOTE The send level can be reduced by up to 12 dB using the dB FROM SEND TLP control. When a frequency other than 2600 Hz is required, an external oscillator can be connected to the SF panel EXT OSC jack. A level of 0 dBm is required to obtain a send level of -20 dBmO (with the dB FROM SEND TLP control set to 0).
6	Press the SF panel SEND OFF HK & DIAL pushbutton.
7	Dial digits 103 using the keypad at the desired PPS, % BRK, and inter-digital time.
8	On seizure, the line under test returns on an off-hook condition (SF panel CKT IDLE indicator extinguished).
9	Dial a digit 1. This provides a ring forward (re-ring) signal.
10	The line under test now returns an on-hook signal (CKT IDLE indicator lit).
11	Dial a digit 1 again. This provides a second ring forward (re-ring) signal.
12	The line under test returns a 120 IPM flash as indicated by the CKT IDLE indicator.

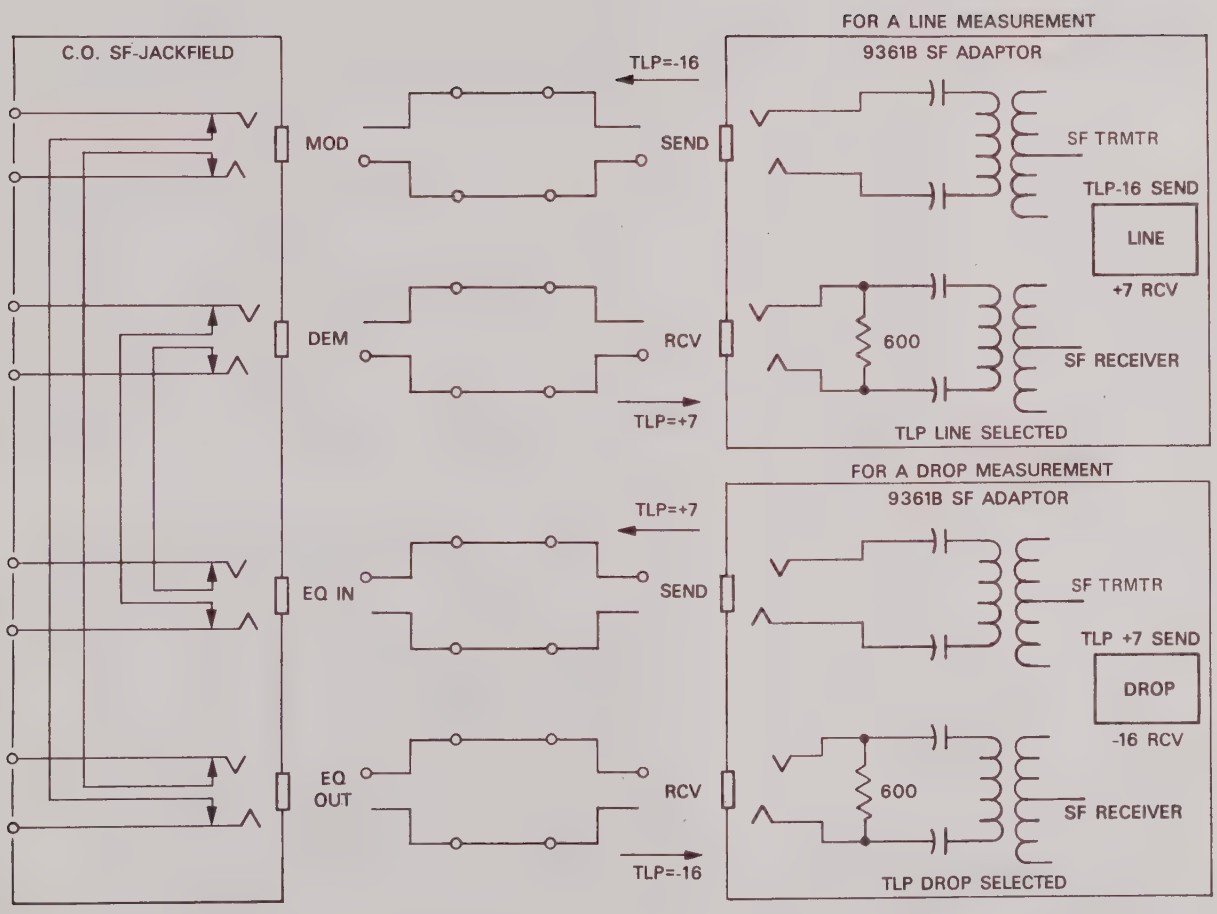

Figure 6-17. SF Adapter SEND/RCV Tests
Toward LINE or DROP

6.10 USING THE ARTIFICIAL TRUNK (Option 6)

With the Artificial Trunk Option unit, a craftsperson can pulse a trunk and measure its response on a local basis.

First, the dc resistance of the loop is duplicated on the option panel. With the far-end opened, the response of the trunk is measured locally. Only one test set is required and it is located at the near end.

6.11 MAKING DX MEASUREMENTS

The DX Adapter (Option 14) must be installed for DX circuit measurements and tests to be made with the Model 9361B Signaling Test Set (see Figure 6-21). When a DX circuit is split, both forward and reverse supervision are controlled, allowing tests toward one end of the circuit while providing on-hook/off-hook supervision toward the opposite end.

Selecting the Monitor function bridges the Adapter across a 2- or 4-wire DX circuit under test to allow circuit signaling parameters to be measured without interrupting traffic.

The Model 9361B may also be used to test DX signaling in combination with Loop/B&G, E&M, and SF (if equipped with Option 5) circuits as shown below:

Send DX	Receive SF
Receive DX	Send SF
Send DX	Receive Loop/B&G
Receive DX	Send Loop/B&G
Send DX	Receive 2W E&M
Receive DX	Send 2W E&M
Send DX	Receive 4W E&M
Receive DX	Send 4W E&M

NOTE: The DX function selected can be 2- or 4-wire.

For procedures for the combined measurements of the combinations in the above table, refer to their respective tables for operating procedures.

The Adapter also provides for the detection of A/B lead reversal and circuit imbalance conditions. An A/B lead reversal causes received pulses to represent % make condition rather than % break condition. The measured % break of received pulses indicates this condition since the % "break" of an A/B lead reversal is the complement of the true % break. For example, if the % break of sent pulses = 64%, an A/B lead reversal will result in an apparent received % break of 36% (100%-64% = 36%).

The closeness of the resistance match between a particular DX set resistance network and the DX loop resistance determines the accuracy with which the unit's DX relay is able to receive pulses. When testing with the Model 9361B DX Option, an appreciable difference between the resistive values found for best balance and the values specified by the CLR card may be caused by an incorrect cable gauge or an error on the CLR card.

Also, the closeness of the match between the DX unit's balance capacitance seen by its DX relay through the repeat coil and down the circuit affects the ability of the receive and transmit functions to work independently. If the near end DX set's balance capacitance value is wrong, the unit will not be able to repeat pulses from its M-lead onto the DX loop without also leaking badly distorted pulses back onto its E-lead. This imbalance causes an uncertain indication of on-hook/off-hook status from the far end. The Model 9361B DX Option uses this indication to determine when the correct balance capacitance is selected.

The Model 9361B may be further used to measure the effects of 60 Hz induction on DX circuit signaling. These effects are determined by slightly offsetting the send pulse pps from an even multiple of 60 Hz (such as 11.9, 12.1, 9.9, or 10.1 pps) and noting the variation in received % break value over several seconds.

Table 6-16. Artificial Trunk

STEP	PROCEDURE
	Refer to Figure 6-18.
1	Select the following switches.
	SEND: — LOOP or B&G (Depending upon type of loop being tested)
	LOOP/B&G: — OFF HK & DIAL
	SEND LOOP RES: — Equal to resistance from test jack to the sender contacts. Normally a small resistance and may be zero.
	SEND LEAK NETWORK: — Equal to the type of contact protection network connected across sender contacts. Normally Network D.
2	Patch the trunk to be tested to the LOOP/B&G SEND jack and select the LOOP mA switch on the Artificial Trunk option panel. The Artificial Trunk unit is now connected as shown in Figure 6-18 and is indicating the LOOP CURRENT on the current meter. Make a note of this LOOP CURRENT value.
3	Disconnect the far-end relay (toothpick or withdraw heat coil) and notice the LOOP CURRENT meter indicating zero. Without loop current, the loop resistance will have no effect on the measurement. Only the trunk capacitance would affect the measurement.
4	Select the ART mA switch on the option panel. The Artificial Trunk unit is now connected as shown in Figure 6-19 and is indicating the current in the ARTIFICIAL TRUNK (the built-in resistance).
5	Adjust ART LOOP RESISTANCE to the same value as the outside loop by matching the LOOP CURRENT meter reading with that noted in Step 2 above.
6	Select the ART TEST switch on the option panel. The circuit arrangement is now as shown in Figure 6-20.
7	Select the desired SEND PPS and SEND % BRK switches and select the LOOP/B&G PULSE pushbutton to send pulses.
8	Select the RECEIVE LOOP/B&G pushbutton and the desired DISPLAY measurement pushbutton. The trunk on test is now being pulsed as a leak network on the WILTRON A-Relay.

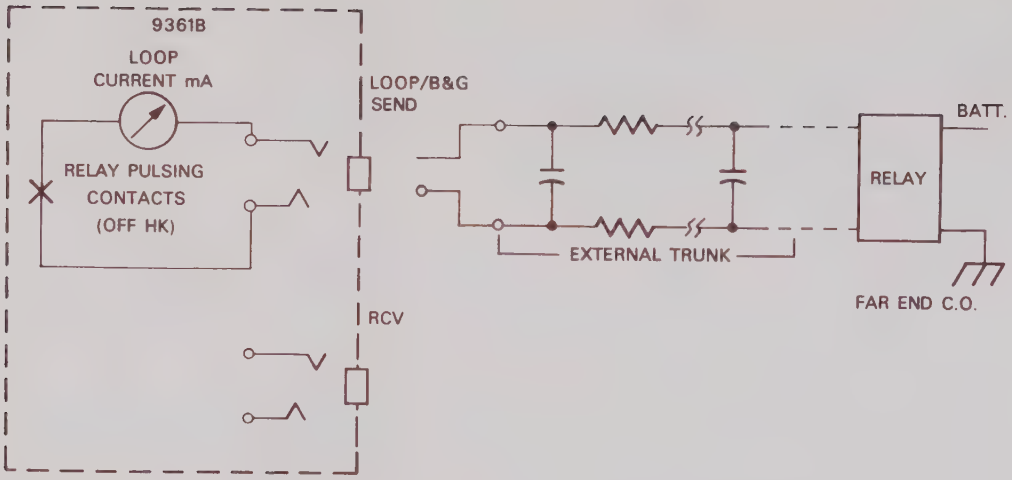

Figure 6-18. Loop Current Measurement

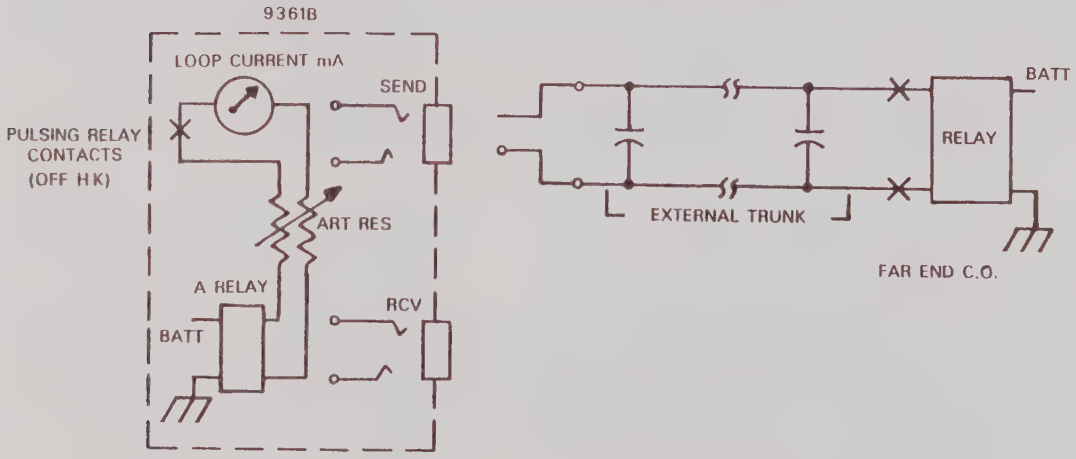

Figure 6-19. Current in the Artificial Trunk

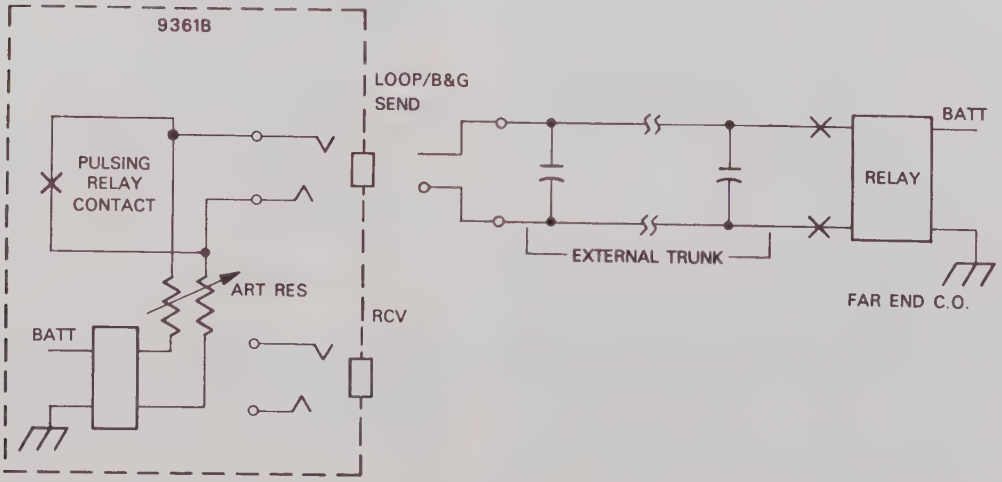

Figure 6-20. External Trunk Distortion Test

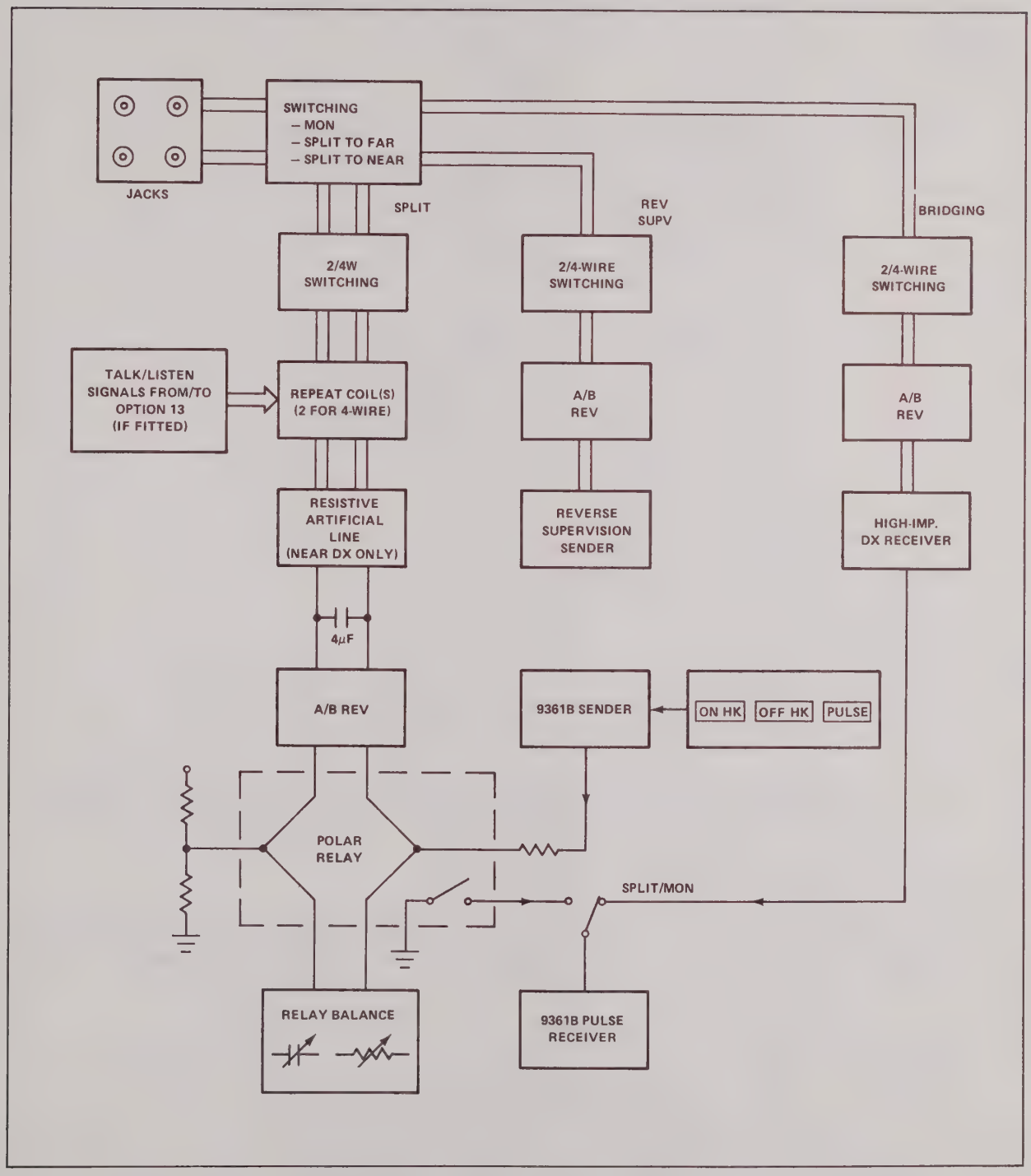

Figure 6-21. DX Option, Block Diagram

Table 6-17. Monitoring a 2-Wire DX Circuit

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-wire: A = tip, B = ring 4-wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found.
	Refer to Figure 6-22.
1	Select the MON THRU switch.
	CAUTION Always connect the patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch from the Model 9361B to the circuit to be monitored. If the DX circuit contains a monitor jack, connect it to either the 2W TO NEAR DX SET or the 2W TO FAR DX SET jack.
3	Select DX ACTIVE RCV and 4 WIRE out.
4	Select the desired DISPLAY pushbutton and make the desired measurements.

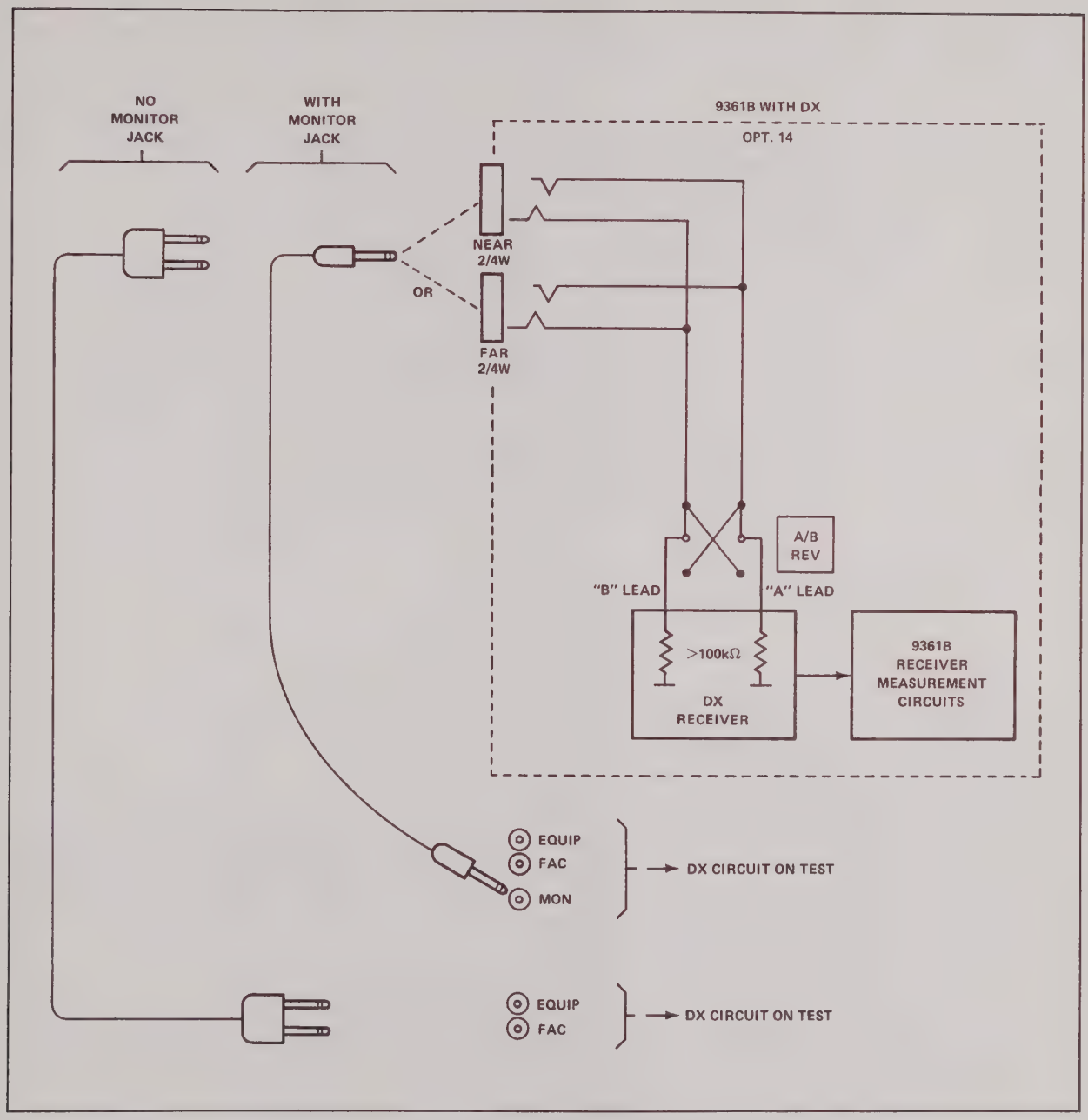

Figure 6-22. 2W DX Monitor with 1 or 2 Jacks

Table 6-18. 2-Wire DX Split to Near DX, Operating Procedures

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-Wire: A = tip; B = ring 4-Wire: A = bottom jacks B = top jacks When making DX measurements, if there is turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found. Refer to Figure 6-23.
1	Select the MON THRU switch.
	CAUTION Always connect a patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch from the 2W TO NEAR DX SET jack to the circuit to be tested. If available, use a double-ended, dual 310 cable to connect near and far ends to the circuit at the same time to provide reverse supervision to the far end.
3	Select the line resistance and capacitance to match the circuit under test (refer to the CLR card).
4	Select DX ACTIVE SEND or RCV as required by the test.
5	Select REV SUPV OFF HK as required to prevent attempted circuit seizure from the far end.
6	Select CKT SPLIT TWD NEAR DX.
7	Select the desired DISPLAY switches as required for received pulse measurements.

(Continued on page 6-32.)

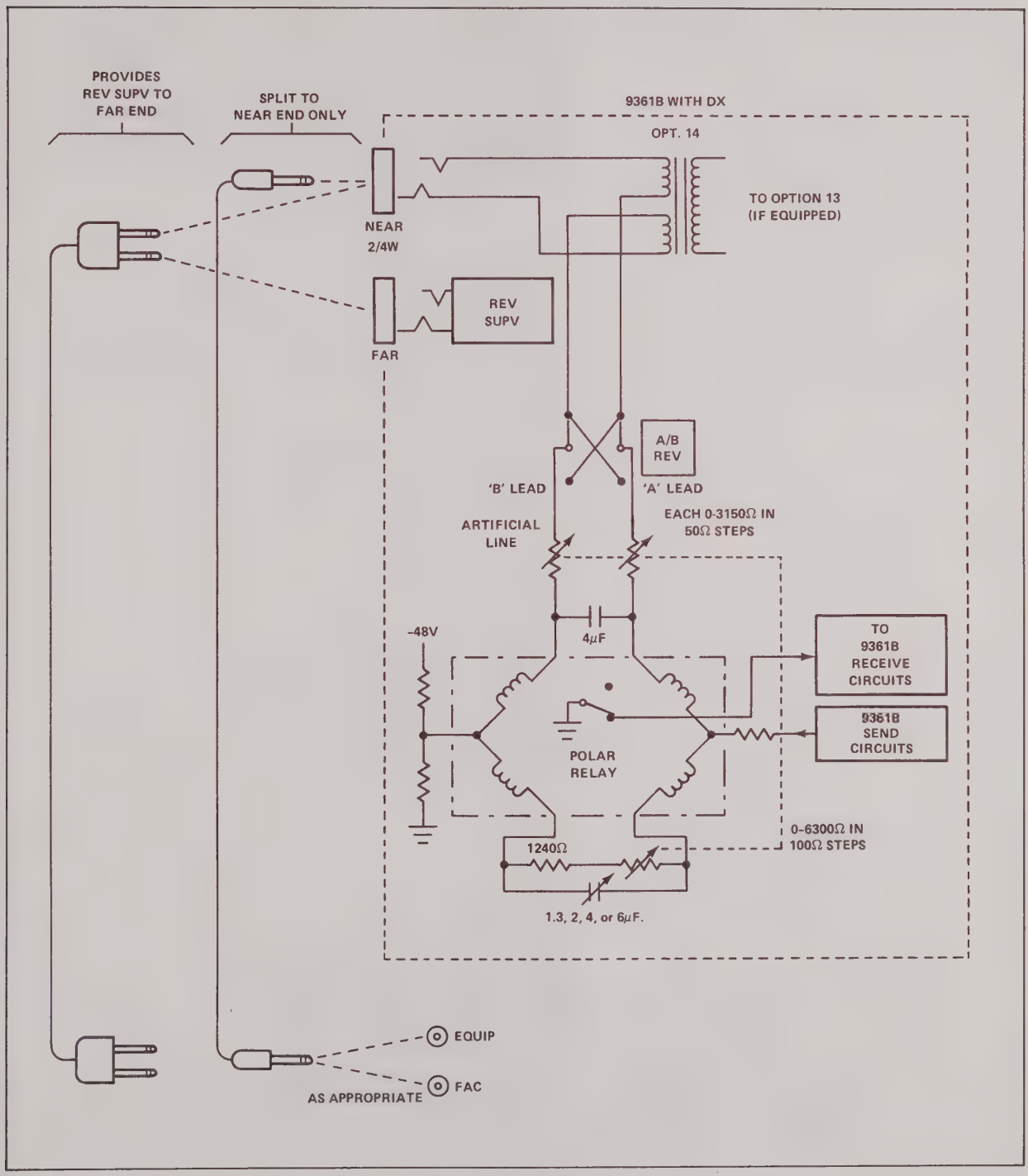

Figure 6-23. 2W DX Split to Near DX

Table 6-18. 2-Wire DX Split to Near DX, Operating Procedures (Continued)

STEP	PROCEDURE
8	If the near end is to receive from the Model 9361B, select SEND PULSE for signaling tests, or OFF HK & DIAL for dialing or talk-path tests. Dial at the desired PPS, % BRK, and inter-digital time using the keypad, or send continuous pulses by selecting SEND SF/DX.

Table 6-19. 2-Wire DX Split to Far DX, Operating Procedures

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-Wire: A = tip; B = ring 4-Wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100 % - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found.
	Refer to Figure 6-24.
1	Select the MON THRU switch.
	CAUTION Always connect the patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch from the 2W TO FAR DX SET jack to the circuit to be tested. If available, use a double-ended dual 310 cable to connect near and far ends to the circuit at the same time to provide reverse supervision to the near end.
3	Select the line resistance and capacitance to match the circuit under test (refer to the CLR card).
4	Select DX ACTIVE SEND or RCV as required by the test.

(Continued on page 6-34.)

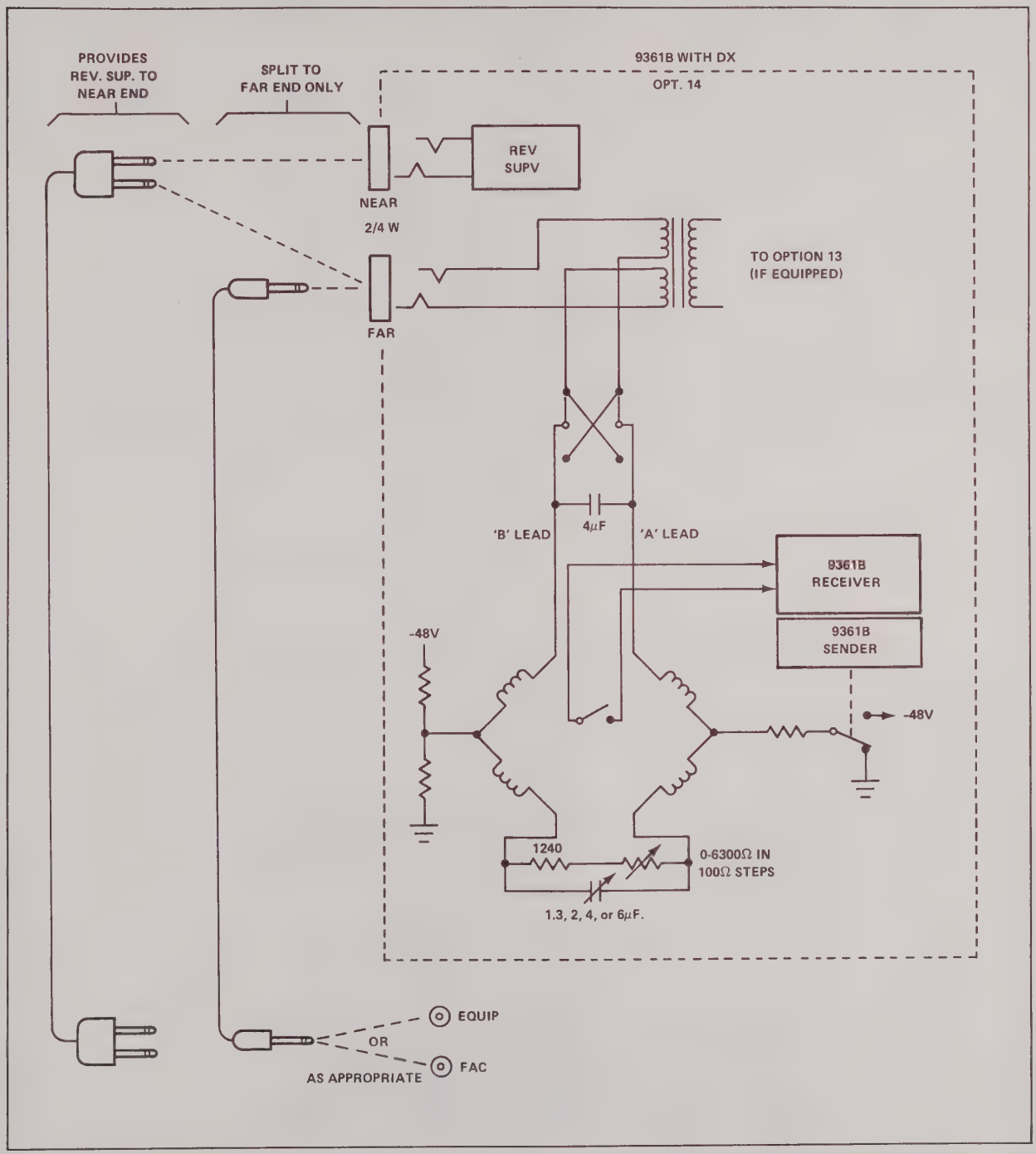

Figure 6-24. 2W DX Split to Far DX

Table 6-19. 2-Wire DX Split to Far DX, Operating Procedures (Continued)

STEP	PROCEDURE
5	Select REV SUPV OFF HK as required to prevent attempted circuit seizure from the far end.
6	Select CKT SPLIT TWD FAR DX.
7	Select the desired DISPLAY switches as required for received pulse measurements.
8	To send to the far end from the Model 9361B, select SEND PULSE for signaling tests, or OFF HK & DIAL for dialing or talk-path tests. Dial at the desired PPS, % BRK, and inter-digital time using the keypad, or send continuous pulses by selecting SEND SF/DX.

Table 6-20. Monitoring a 4-Wire DX Circuit

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-Wire: A = tip; B = ring 4-Wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found. Refer to Figure 6-25.
1	Select the MON THRU switch.

(Continued on page 6-36.)

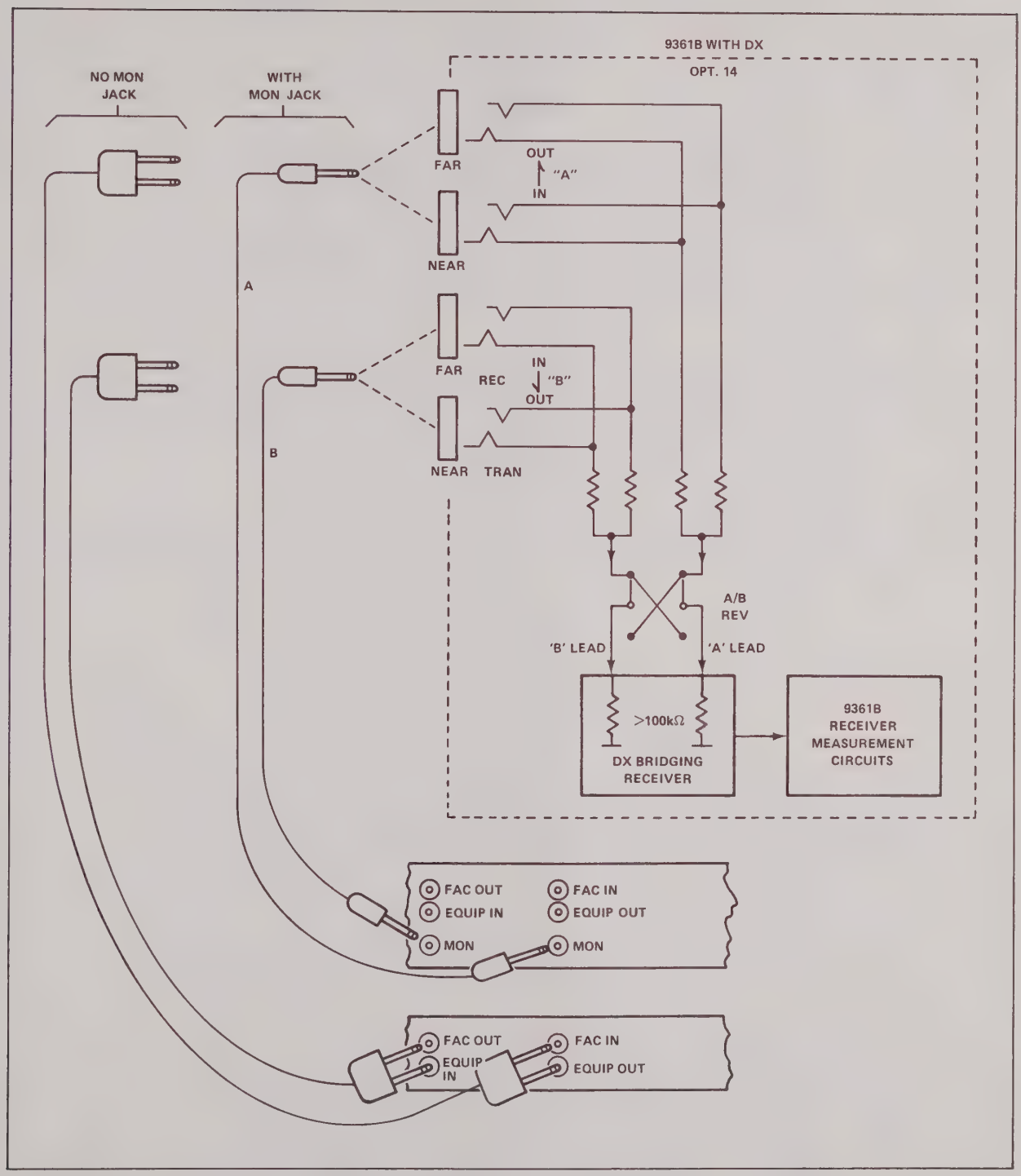

Figure 6-25. 4W MON THRU

Table 6-20. Monitoring a 4-Wire DX Circuit (Continued)

STEP	PROCEDURE
	CAUTION Always connect the patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch from the Model 9361B to the circuit to be monitored. If the DX circuit contains a monitor jack, connect it to either the far DX pair or the near DX pair of jacks using 2 double-ended 310 patch cords or 1 dual cord. If no monitor jacks are provided, use 2 double-ended, dual 310 plug patch cords to connect the near to far side of the circuit through the 4W ⟵ jacks and connect the far to near side of the circuit through the 4W ⟶ jacks.
3	Select DX ACTIVE RCV and 4 WIRE.
4	Select the desired DISPLAY pushbutton and make the desired measurements.

Table 6-21. 4-Wire DX Split to Near DX, Operating Procedures

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-Wire: A = tip; B = ring 4-Wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found.
	Refer to Figure 6-26.
1	Select the MON THRU switch.
	CAUTION Always connect a patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch from the NEAR DX pair of jacks to the near end circuit to be tested, observing the direction of transmission indicated by the arrows. If available, use two double-ended dual 310 plug cables to connect near and far DX ends to the circuit at the same time to provide reverse supervision to the far end.
3	Select the line resistance and capacitance to match the circuit under test (refer to the CLR card).
4	Select 4 WIRE.
5	Select DX ACTIVE SEND and/or RCV as needed by the test.
6	Select REV SUPV ON HK as required to prevent attempted circuit seizure from the far end.
7	Select CKT SPLIT TWD NEAR DX.
8	Select the desired DISPLAY switches as required for received pulse measurements.

(Continued on page 6-39.)

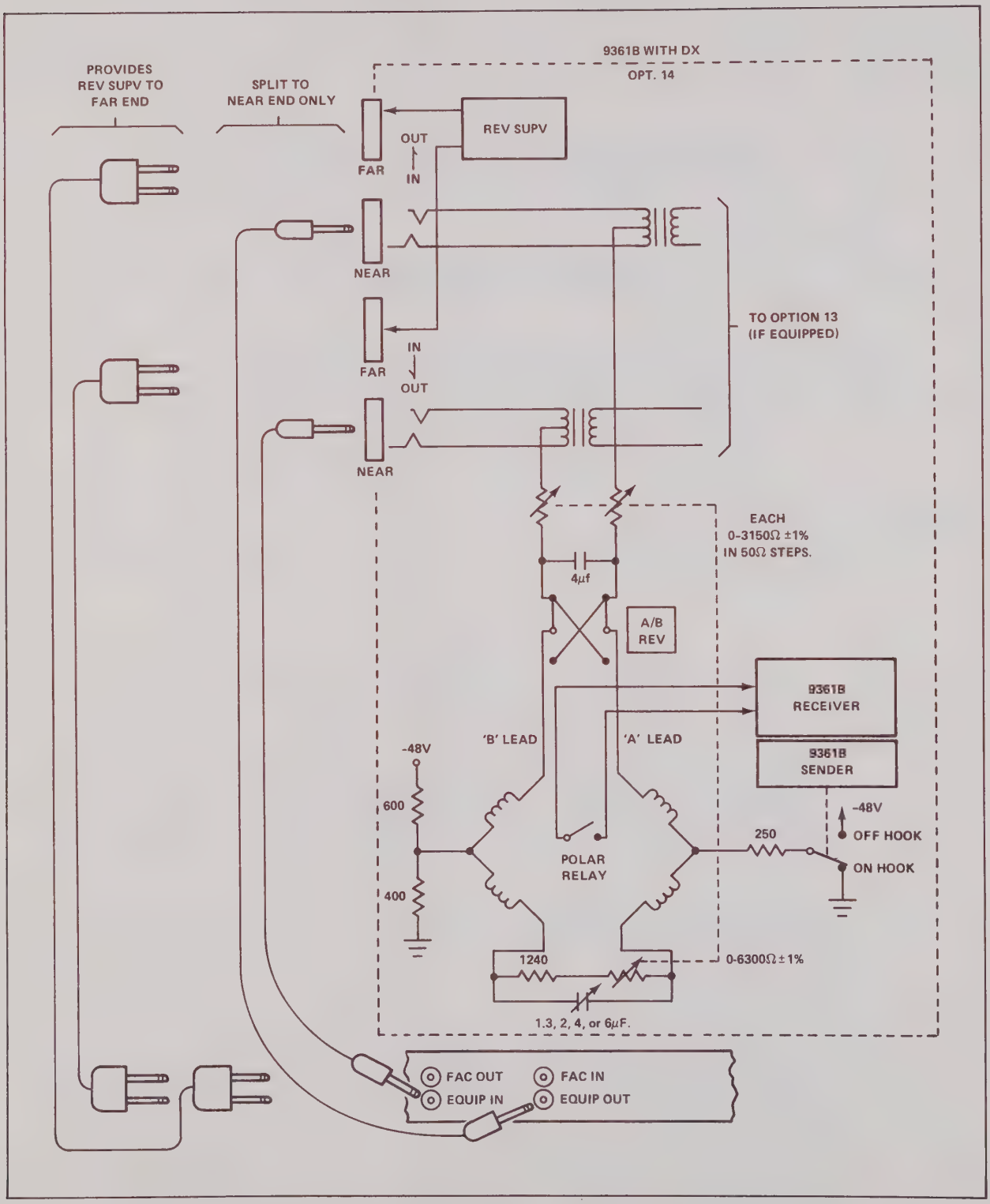

Figure 6-26. 4W DX Split to Near DX

Table 6-21. 4-Wire DX Split to Near DX, Operating Procedures (Continued)

STEP	PROCEDURE
9	To send to the near end from the Model 9361B, select SEND PULSE for signaling tests or OFF HK & DIAL for dialing or talk-path tests. Dial at the desired PPS, % BRK, and inter-digital time using the keypad, or send continuous pulses by selecting SEND SF/DX.

Table 6-22. 4-Wire DX Split to Far DX, Operating Procedures

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-wire: A = tip, B = ring 4-wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found. Refer to Figure 6-27.
1	Select the MON THRU switch. CAUTION Always connect a patch cable to the Model 9361B first before connecting to the DX circuit under test to prevent possible service interruption.
2	Patch the FAR DX pair of jacks to the far-end circuit to be tested, observing the direction of transmission indicated by the arrows. If available, use 2 double-ended, dual 310 plug cables to connect near and far ends to the circuit at the same time to provide reverse supervision to the near end.

(Continued on page 6-41.)

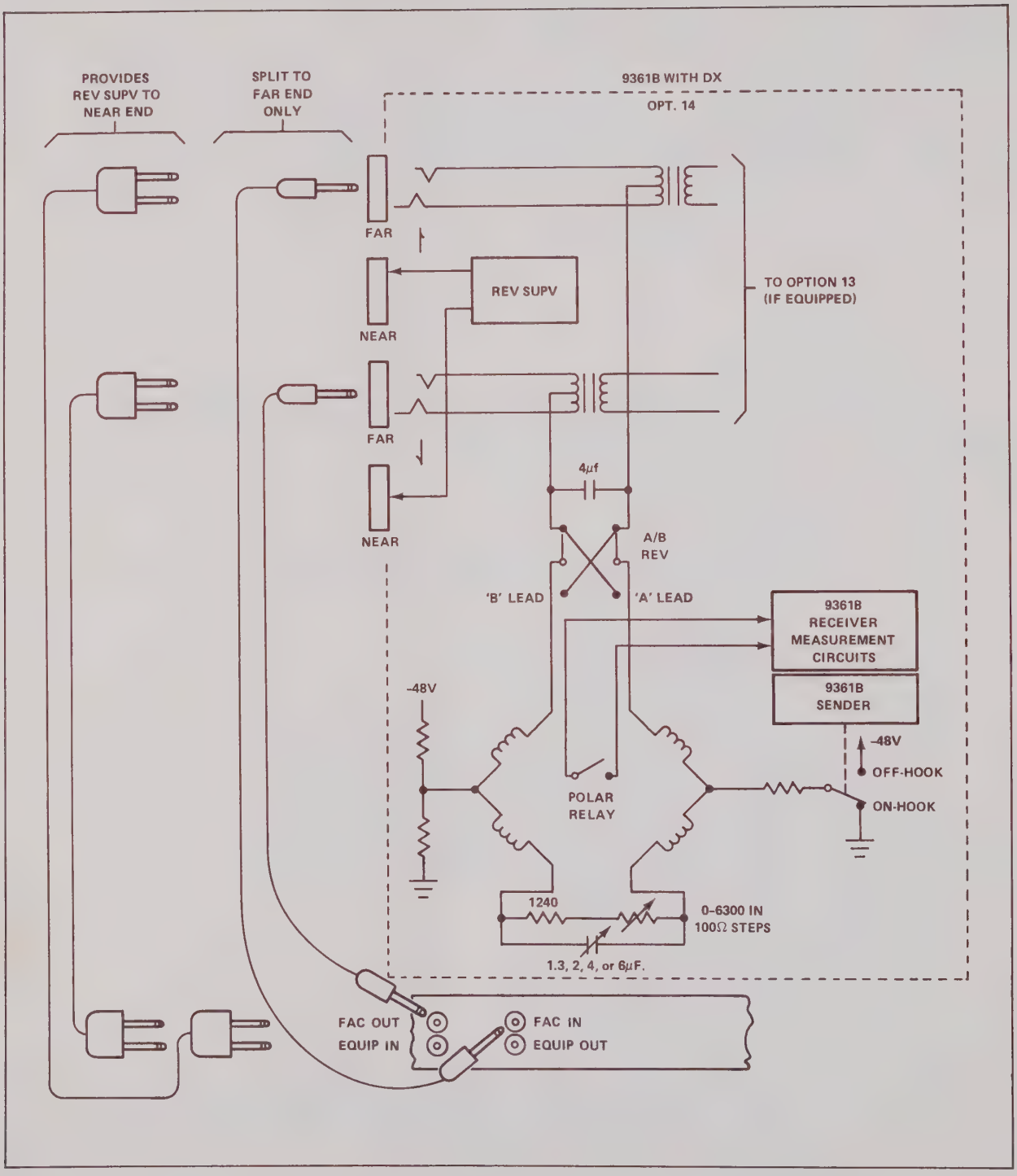

Figure 6-27. 4W DX Split to Far DX

Table 6-22. 4-Wire DX Split to Far DX, Operating Procedures (Continued)

STEP	PROCEDURE
3	Select the line resistance and capacitance to match the circuit under test (refer to the CLR card).
4	Select 4 WIRE.
5	Select DX ACTIVE SEND and/or RCV as needed by the test.
6	Select REV SUPV ON HK as required to prevent attempted circuit seizure from the far end.
7	Select CKT SPLIT TWD NEAR DX.
8	Select the desired DISPLAY switches as required for received pulse measurements.
9	To send to the far end from the Model 9361B, select SEND PULSE for signaling tests, or OFF HK & DIAL for dialing or talk-path tests. Dial at the desired PPS, % BRK, and inter-digital time using the keypad, or send continuous pulses by selecting SEND SF/DX.

Table 6-23. Adjusting the Balance Network Resistance of a DX Set

STEP	PROCEDURE
	NOTE The closeness of the match between a particular DX unit's balance resistance and the resistance looking down the loop determines how much pulse distortion is produced by its DX relay. Changing the on- or off-hook condition sent from the DX unit while it is receiving DX pulses will show how closely the resistances are matched. NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-wire: A = tip, B = ring 4-wire: A = bottom jacks B = top jacks

Table 6-23. Adjusting the Balance Network Resistance of a DX Set (Continued)

STEP	PROCEDURE
	When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found.
	Refer to Figure 6-24 for 2-wire DX and Figure 6-27 for 4-wire DX tests.
	NOTE This procedures requires the use of 2 Model 9361B Signaling Test Sets, each equipped with Option 14.
1	Select the DX MON THRU switch on both Model 9361Bs.
	CAUTION Always connect the patch cable to the Model 9361B first before connecting to the circuit under test to prevent possible service interruption.
2	At the circuit near and far ends, patch from the TO FAR DX SET ⟶(2W or 4W, as required by the circuit under test) jack to the far-end circuit to be tested. If available, use 2 double-ended, dual 310 plug cables to connect the near and far ends to the circuit at the same time, to provide reverse supervision to the near end.
3	At the far end, set the Model 9361B controls as follows: 9361B SEND: SF/DX SEND PPS: 11.9 or 12.1 (to produce a beat with any 60 Hz on the line) SEND % BRK: 64 DX Panel: CKT SPLIT: TWD FAR DX SEND: PULSE 4 WIRE: in or out as needed by the circuit under test REV SUPV: ON HK DX ACTIVE: SEND
4	At the near end, set the Model 9361B controls as follows: 9361B RECEIVE: SF/DX DISPLAY: % BRK DX Panel CKT SPLIT: TWD FAR DX 4 WIRE: in or out as needed by the circuit under test

Table 6-23. Adjusting the Balance Network Resistance of a DX Set (Continued)

STEP	PROCEDURE
	SEND: ON HK REV SUPV: ON HK DX ACTIVE: RCV LINE RES & RELAY BALANCE: to match the circuit order card.
5	Note the percent break reading.
6	Press the near end DX Panel SEND OFF HK & DIAL to place the near end off-hook.
7	Note the percent break reading. Refer to the following to determine if the near end balance resistance is too large, too small, or correct:

Near End Balance Resistance	% Break Received By Near End On Hook	% Break Received By Near End Off Hook
Too Large	Lower	Higher
Too Small	Higher	Lower
Correct	Same	±0.1% Bk.

8	Select alternate LINE RESISTANCE combinations and switch to near end between ON HK and OFF HK & DIAL until the % break noted in steps 5 and 7 are the same.

NOTE

A big difference between the best balance resistance found and the resistance shown on the circuit design card suggests a fault on the line or a mistake in the circuit design.

9	To accurately measure the line resistance, short T and R together at the distant end, then measure between T and R at the near end with a multimeter cable analyzer (such as a WILTRON 9102A).
10	Proceed with standard practices for correcting DX set line resistance settings using the resistance value found in step 8.

Table 6-24. Adjusting the Balance Network Capacitance of a DX Set

NOTE

The closeness of the match between a particular DX unit's balance capacitance and the capacitance seen by its DX relay looking through the repeat coils and down the DX loop determine how independent the DX unit's send and receive circuits are.

Capacitance unbalance shows up as erroneous pulses being seen on the E-lead indicator when M-lead pulses are being sent into the DX unit.

Table 6-24. Adjusting the Balance Network Capacitance of a DX Set (Continued)

STEP	PROCEDURE
	NOTE Before making DX measurements, the position of the A/B REV button should be set to match the convention of the circuit under test. The WILTRON A/B lead convention is 2-wire: A = tip, B = ring 4-wire: A = bottom jacks B = top jacks When making DX measurements, if there is a turnover, the ON/OFF supervision indicator will be reversed and the % break measured will be the complement (100% - % break; that is, 64% reads 36%). Operating the A/B REV button will correct these indications. The cause of the A/B turnover should then be found. Refer to Figure 6-24 for 2-Wire DX and Figure 6-27 for 4-Wire DX tests. NOTE This procedure requires the use of a Model 9361B Signaling Test Set equipped with Option 14.
1	Select the DX MON THRU switch on the Model 9361B. CAUTION Always connect a patch cable to the Model 9361B first before connecting to the circuit under test to prevent possible service interruption.
2	Patch from the TO FAR DX SET (2W or 4W as required by the circuit under test) jack to the far end circuit to be tested. If available, use double-ended, dual 310 plug cables to connect near and far ends to the circuit at the same time to provide reverse supervision to the far end.
3	Set the Model 9361B switches as follows: 9361B SEND: SF/DX SEND PPS: 10 SEND % BRK: 64 RECEIVE: SF/DX DISPLAY: % BRK MF/DTMF COMM PANEL (if equipped): SIGNALING MODE: DIAL PULSE TALK CIRCUIT: OFF

Table 6-24. Adjusting the Balance Network Capacitance of a DX Set (Continued)

STEP	PROCEDURE
	DX Panel: CKT SPLIT: TWD FAR DX SEND: PULSE 4 WIRE in or out as needed by the circuit under test for 2- or 4-wire operation. REV SUPV: ON HK DX ACTIVE: SEND RCV LINES RES & RELAY BALANCE: resistance to match the circuit order card
4	Look closely at the SPLIT SUPV lamp; if it is flashing, proceed to Step 5.
5	Select different combinations of Relay Balance capacitance on the DX Adapter panel until the supervision indicator stops flashing.
6	If no other problems that may be causing the network imbalance are obvious, use the capacitance value found in step 5 and proceed with standard practices for correcting DX set network capacitance.

SECTION VII
MAINTENANCE

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7.01 GENERAL

The 9361B Signaling Test Set will provide long periods of service with little routine maintenance.

The performance of the A-Relay and the Send Pulsing Relay should be checked periodically using the procedures given in Tables 4-7 and 4-10. If their performance is outside the limits given there, follow the maintenance procedures given in this section. If the A-Relay maintenance procedure is beyond the scope of your facility, a precalibrated A-Relay may be ordered from WILTRON. The part number is 9361B-C-7912.

7.02 CALIBRATING THE A-RELAY

These tests should only be performed if the unit has failed the tests given in Table 4-10. Adjustments to the A-Relay include adjustments to:

a) Air Line Gap
b) Residual Air Gap
c) Spring Gauging
d) Armature Backstop
e) Relay Margining

7.03 EQUIPMENT REQUIRED

Current Flow Test Set (Automatic Electric H882790 or equivalent)

The following tools are also needed:

1 - Set of gauges (non-magnetic): Neuses N-82-ss-25*
1 - Airline "T" Gauge: Neuses N-436A*
1 - Armature Bender: Neuses SA-8*
1 - Spring Tension Bender: Neuses N-416B*
1 - Contact Burnisher: Neuses CB-5*
1 - Open-end wrench, 1/4-inch
1 - Slotted screwdriver

*Order from:

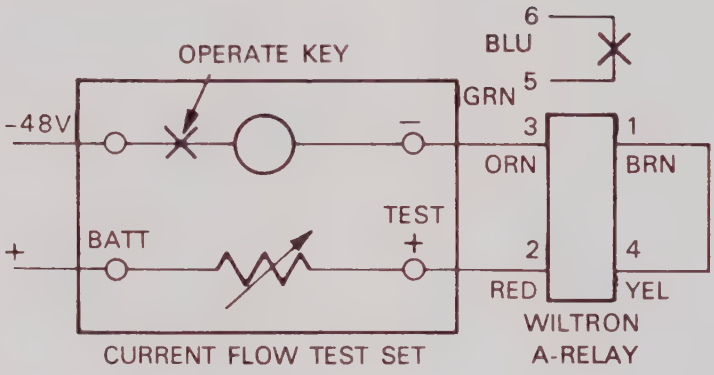
P.K. Neuses, Inc.
1401 Rohlwing Road
Rolling Meadows, IL 60008
Ph: (312) 253-6555

7.04 REMOVING THE A-RELAY FOR MECHANICAL TESTS

Remove the top cover of the 9361B. Remove the A-Relay on its mounting bracket by removing two mounting screws and carefully lifting the white plastic Molex connector on the A-Relay wires from the mating PC board connector.

7.05 CONNECTING THE CURRENT FLOW TEST SET

Connect the A-Relay to the Current Flow Test Set as shown in Figures 7-1a and 7-1b.



BRN 1	--	RES 1
RED 2	--	GND (BAT RET)
ORN 3	--	-48V
YEL 4	--	RES
GRN 5	--	common contact
BLU 6	--	N.O. contact

Figure 7-1a. Connecting the Current Flow Test Set

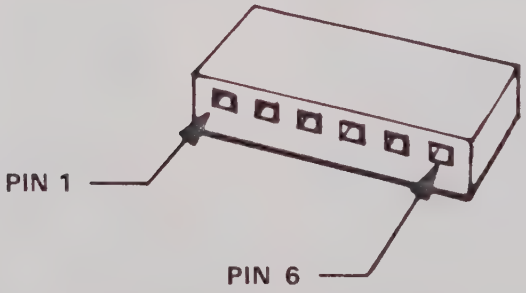


Figure 7-1b. Molex Connector Pin Designations

7.06 THE AIR LINE GAP

1. With a 0.0015-inch gauge between the armature and the heel piece (airline gap, Figure 7-2), operate the relay. No drag should be felt as the 0.0015-inch gauge is slowly withdrawn. Check both positions indicated in Figures 7-2 and 7-3. Release the relay.

2. Insert a 0.004-inch gauge between the armature and the heel piece (airline gap) and operate the relay. The 0.004-inch gauge should have a uniform strong drag. Release the relay.

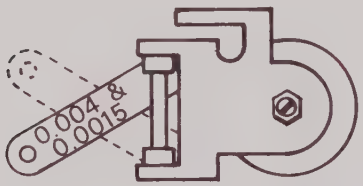


Figure 7-2. Feeler Gauge Locations for the Air Line Gap

3. If air line gap tests 1 and 2 are not met, perform the airline gap adjustments in steps 4 through 7.

4. Air line adjustment: Loosen the clamp screw and the residual screw (see Figure 7-3).

5. Place a 0.003-inch "T" gauge between the heel piece and the armature. Refer to Figure 7-4.

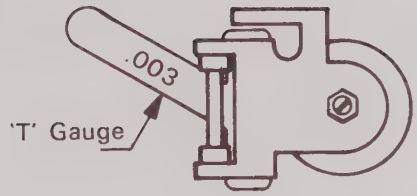


Figure 7-4. Inserting the 0.003-inch "T" Gauge

6. Operate the relay. Hold the armature firmly against the "T" gauge while tightening the clamp screw.

7. Release the relay and remove the "T" gauge.

8. Repeat steps 1 and 2.

7.07 RESIDUAL AIR GAP

1. Place a 0.009-inch gauge between the core and the armature such that the residual screw goes through the hole in the gauge (refer to Figure 7-5). Operate the relay.

2. Move the gauge up and down. A slight uniform drag should be felt until the screw touches the gauge. Release the relay and remove the gauge.

3. Use a 0.008-inch gauge and repeat steps 1 and 2; this time no drag should be felt as the gauge is moving.

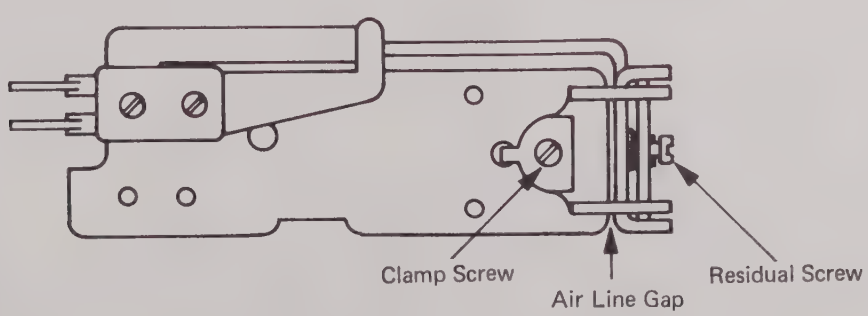


Figure 7-3. Air Line Adjustment

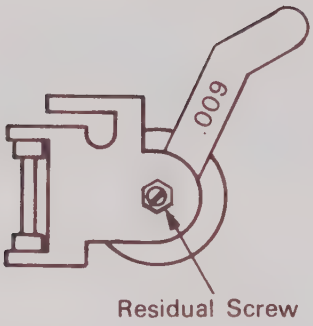


Figure 7-5. Residual Air Gap

4. Use a 0.010-inch gauge and repeat steps 1 and 2; this time a constant tight drag should be felt while the gauge is moving.

5. If the residual tests are not met, perform the residual adjustments in steps 6 through 9.

6. Place a 0.009-inch gauge between the core and the armature such that the residual screw goes through the hole in the gauge (refer to Figure 7-5). Release the relay.

7. Loosen the residual locking nut and adjust the residual screw so that when the 0.009-inch gauge is moved up and down, a slight uniform drag is felt.

8. Tighten the residual locking nut using the open wrench, while the residual screw is firmly held in place with the screwdriver. Release the relay.

9. Recheck steps 1 through 5.

7.08 SPRING-GAUGING

1. Place the solid end of a 0.007-inch gauge between the armature and the core; then, operate the relay (refer to Figure 7-6).

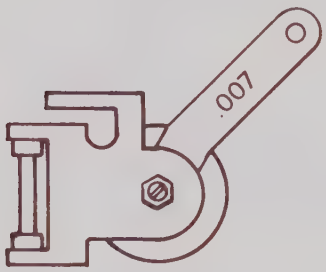


Figure 7-6. Spring-Gauging

The contact between springs 1 and 2 (see Figure 7-7) should not break. Verify by using ohmmeter between springs 1 and 2. Release the relay.

STEP#	CONTACT SPRINGS 3 2 1	CONTACT STATUS	FEELER GAUGE SIZE BETWEEN ARMATURE AND CORE
1		Not Break 1-2	0.007
2		Break 1-2	0.006
3		Not Make 2-3	0.005
4		Make 2-3	0.004

Figure 7-7. Summary of Spring-Gauging Tests

2. Place the solid end of a 0.006-inch gauge between the armature and the core; then, operate the relay. The contact between springs 1 and 2 should break. Verify by using ohmmeter between springs 1 and 2.

3. Using the solid end of a 0.005-inch gauge between the armature and the core, operate the relay. Contacts 2 and 3 should not make. Verify by using the ohmmeter between contacts 2 and 3. Release the relay.

4. Place the solid end of a 0.004-inch gauge between the armature and the core; then, operate the relay. Contacts 2 and 3 should make. Verify by using ohmmeter between contacts 2 and 3. Release the relay.

5. If spring gauging tests 1 through 5 are not met, perform the spring gauging adjustments in steps 6 through 9.

6. Spring Adjustments: Place the solid end of a 0.006-inch gauge between the armature and the core; then, operate the relay. Using the armature bender (NEUSES 5A-8), adjust the armature lever arm until contacts 1 and 2 open. Verify by using ohmmeter between contacts 1 and 2. Release the relay.

7. Place a 0.007-inch gauge between the armature and the core; then, operate the relay. Contacts 1 and 2 should not open. Verify by using an ohmmeter between contacts 1 and 2. If contacts do break, use the armature bender to adjust the armature lever arm. Steps 6 and 7 have to be met simultaneously.

8. Place a 0.004-inch gauge between the armature and the core; then, operate the relay. Contacts 2 and 3 should make. Verify with the ohmmeter. If contacts do not make, use a spring adjuster tool (NEUSES N-416B) to bend spring 3 until it makes contact with spring 2. Release the relay.

9. Place a 0.005-inch gauge between the armature and the core; then, operate the relay. Contacts 2 and 3 should not make. Verify with the ohmmeter. If contacts do make, use a spring adjuster tool to bend spring 3 until it does not make contact with spring 2. Requirements of steps 8 and 9 have to be met simultaneously. Release the relay.

7.09 ARMATURE BACKSTOP

1. With the relay de-energized, manually push the armature until the lever arm makes physical contact with spring 2 (see Figure 7-8). Measure the armature backstop to be .008 inch ± .002 inch. If the backstop is not met, perform the backstop adjustment in step 2, below.

2. Backstop Adjustment: With the relay de-energized, manually push the armature until the lever arm makes physical contact with spring 2. Bend the backstop until a 0.010 feeler gauge will not go into the gap, but a 0.006 feeler gauge will.

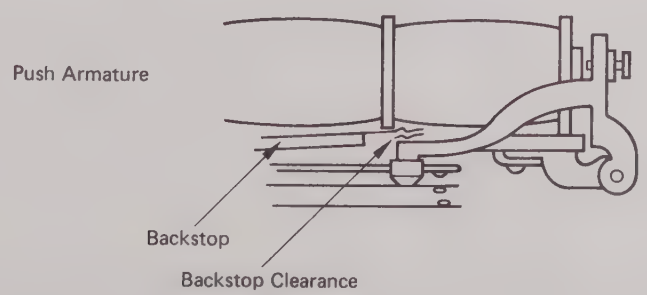


Figure 7-8. Adjusting the Armature Backstop

7.10 RELAY-MARGINING TEST: SOAKING THE A-RELAY

1. Using the same test setup (Figure 7-1), operate the relay. Press the SOAK key on the Current Flow Test Set. This momentarily increases the relay current to about 50mA. Release the SOAK key.

2. With the relay energized, set the current flow to 14.8mA. Release the relay.

3. Operate the relay again; verify that spring contacts 3 and 4 make (see Figure 7-7).

4. Reduce the relay current to 14.4mA.

5. Release the relay; then operate the relay again. Verify that spring contacts 3 and 4 DO NOT make (see Figure 7-7). Release the relay.

6. The requirements of steps 2 through 5 have to be met simultaneously. If they are not met, do the margining adjustments in steps 7 and 8.

7. Operate the relay; set the relay current to 14.8mA. Release the relay. Operate the relay again; check that contacts 3 and 4 make. If the contacts do not make, then the tension of spring 2 is too stiff. Use the spring adjuster tool (NUESES N-416B) to loosen the tension of spring 2 (refer to Figure 7-8).

8. Operate the relay; adjust the relay current to 14.4mA. Release the relay. Operate the relay again; check that contacts 2 and 3 DO NOT MAKE. If the contacts make, then the tension of spring 2 is too loose. Use the spring adjuster tool to make the tension of spring 2 stiffer (refer to Figure 7-9).

NOTE

The requirements of steps 7 and 8 have to be met simultaneously.

7.11 SUMMARY OF ADJUSTMENTS

Check the A-Relay to the tolerances in Figure 7-10. If they are met, repeat the electrical checkout given in Table 4-10.

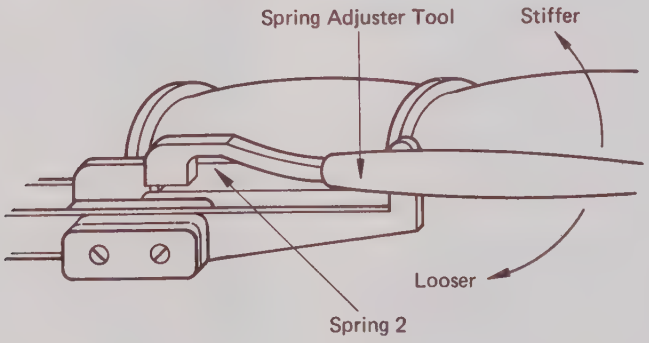


Figure 7-9. Relay Margining

Airline Gap:	0.003 inch	Backstop:	0.008 ±0.002 inch
Residual Gap:	0.009 inch	Operate Current:	14.8mA
Spring Gauging:	1 o-------- 2 o-----.006 Break / .004 Make 3 o--------	Non-Operate Current:	14.4mA

Figure 7-10. A-Relay Tolerances

7.12 SF SENDER ADJUSTMENT

This check is for the SF Send circuits. Make this adjustment only when the Performance Verification procedures indicate that adjustment is required.

(A) Equipment Required

1. Oscillator, 2600 Hz: WILTRON DTMS, HP 651, or HP 200CD
2. Voltmeter/Level Meter, +10 to -52 dBm: WILTRON DTMS or Fluke 8000
3. Frequency Counter: WILTRON DTMS or Fluke 1900A
4. 23 dB Attenuator: ±0.1 dB accuracy

(B) SF Sender Adjustment

1. Connect the oscillator (600 ohm) to the EXT OSC jack and adjust the oscillator for 2600 Hz, 0 dBm (.775V rms).
2. Remove the top cover.
3. On the 9361B, select the following switches:

   SEND: SF

   SF TLP: DROP

   SF SEND: ON HK

4. Connect the voltmeter or level meter (terminated into 600 ohms) to the SF SEND jack.
5. Set the OUT ADJ potentiometer (R66) on the SF unit to obtain an indication of -13.0 dBm (0.22V rms).
6. Remove the external oscillator from the EXT OSC jack and connect the frequency counter to the SF SEND jack.
7. Select the following switches:

   SF TLP: DROP

   SF SEND: ON HK

   Set R57, FREQ ADJ potentiometer on the SF unit, for an indication of 2600 ±1 Hz.

8. Remove the frequency counter and install the voltmeter (or level meter) terminated into 600 ohms. Set R56, LEVEL ADJ potentiometer on the SF unit, for an indication of -13.0 dBm (0.22V rms).

7.13 SF RECEIVER CALIBRATION

Do not perform these checks until the SF Sender checks are completed.

1. Select the following switches on the 9361B:

   SEND: SF

   RECEIVE: SF

   SF SEND: OFF HK

   SF TLP: DROP

2. Set the external oscillator (600 ohm) to 2600 Hz and -15.5 dBm (.130V rms into 600 ohms). Connect it to the SF RCV jack.
3. Adjust R30, RCVR GAIN potentiometer, so that the RCV OVERLOAD indicator just goes on. R30 is located just below and to the left of the CMR ADJ potentiometer.

7.14 SF % BREAK CALIBRATION

1. Select the following switches on the 9361B:

   SEND PPS: 12
   SEND % BREAK: Any preset value
   SEND: SF
   RECEIVE: SF
   DISPLAY: % BRK
   SF TLP: DROP
   SF SEND: PULSE
   dB BELOW SEND TLP: OFF

2. Connect the SF SEND jack to the SF RCV jack through a 23 dB attenuator.
3. Adjust R45, % BK ADJ potentiometer, for a display reading as selected in step 1 above, ±0.1 % BRK.

7.15 ADJUSTING THE SEND PULSING RELAY

This procedure should be performed only if the Send Pulsing Relay has been replaced or if it does not meet the standards set in Table 4-7. OTHERWISE, DO NOT MAKE ANY ADJUSTMENTS.

1. Select the following switches on the 9361B:

RECEIVE:	MON SEND
DISPLAY:	% BREAK
LOOP/B&G:	PULSE
	TERM
SEND:	B&G
	12 PPS
	First SEND % BREAK button (58 or 60.5)

   Check that the display reads the value selected ±0.2% BRK.

2. Press the RECEIVE: LOOP/B&G button. The display should read 58.0% Break ±0.2%, (or other value as selected).

3. If either indication is incorrect, remove the top cover and adjust R20, located at the top and rear of the 9361B on the center PC board.

4. Repeat steps 1, 2, and 3 until a correct indication is obtained.

7.16 REPLACING THE DX RELAY

1. Remove the 2 screws securing the top cover of the Model 9361B, then remove the cover.

2. Remove the 2 screws holding the DX Relay circuit board to the DX Adapter circuit board and Model 9361B mainframe (on the left side while facing unit -- see Figure 7-11).

3. Unplug the DX Relay circuit board from the DX Adapter board.

4. Remove the DX Relay circuit board from the Model 9361B.

5. Plug in the new relay. Reverse the procedures in steps 2 and 1.

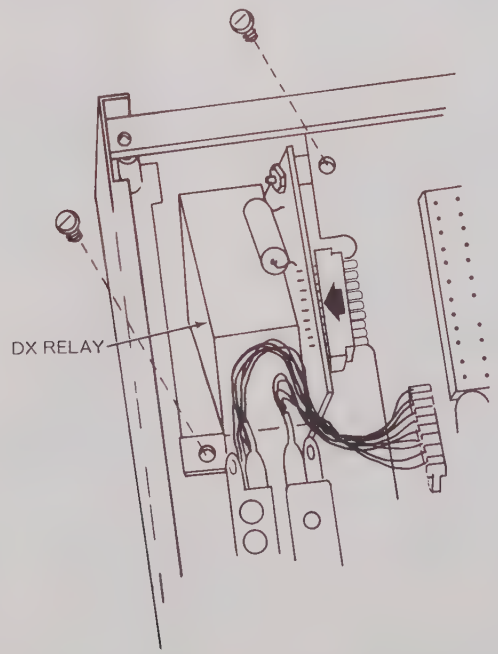


Figure 7-11. DX Adapter, Showing Mounting of DX Relay

SECTION VIII

TROUBLESHOOTING PROCEDURES

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8.01 GENERAL

The Model 9361B is designed to give long periods of trouble-free service. The only components that the user should replace are fuses and ballast lamps. If any other failures occur, contact a WILTRON representative or call WILTRON Customer Service at (415) 969-6500.

8.02 SYMPTOMS OF FAULTS

(A) Does Not Send LOOP/B&G

Remove the top cover and check the two fuses on the LOOP Board Assembly. If necessary, replace with 0.6 Amp Fast-Blo fuses, WILTRON Part Number 631-15.

(B) Does Not Send E&M or LOOP/B&G

Check the ballast lamps (resistance lamps) as follows:

1. Press the SEND-B&G button.
2. Press the LOOP/B&G-OFF HK & DIAL button.
3. Remove the top cover from the 9361B.
4. Insert a patch cord into the LOOP/B&G SEND jack.
5. Remove the top cover.
6. Short the tip and ring on the patch cord. Both resistance lamps should light. (The resistance lamps are located in the middle of the unit.)
7. If the lamps fail to light, disconnect the -48V or ac power. Check the resistance of the lamps on the PC board with an ohmmeter. They should have a resistance of approximately 10 ohms (cold).
8. Replace the resistance lamps if necessary. Use W.E. CO. Type 19A Lamps, WILTRON Part Number 632-34.
9. Replace the top cover.

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